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THESIS

EFFECTIVENESS OF INTRODUCTORY FLIGHT SCREENING (IFS) FOR UNITED STATES NAVY AND MARINE CORPS STUDENT PILOTS

by

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September 2006

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This study examined the effectiveness of Introductory Flight Screening (IFS) for U.S. Navy and Marine Corps student pilots. It compared a non-IFS group to an IFS-complete group to determine if IFS had any effect on Primary drop-on-request (DOR) and flight-failure (FF) attrition. It then examined the return on investment (ROI) of the IFS program utilizing T-34 flying-hour costs, active-duty costs, and opportunity cost-savings of IFS-screened students who did not enter undergraduate pilot training. Results suggest that IFS did not have an effect on the DOR rate and may have produced the undesired effect of delaying the DOR-student's decision until later in the syllabus. IFS had a desirable effect on the FF attrition rate with no significant change in T-34 flight hours per FF. The combined Primary DOR and FF rate, although significantly lower, did not achieve expectations. The ROI analysis was completed with both composite-pay costs and Individual Account costs. In both cases, the IFS-investment costs significantly outweighed the IFS savings resulting in a net loss and an undesirable ROI. Several alternatives were discussed as possible improvements to the current IFS program.

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EFFECTIVENESS OF INTRODUCTORY FLIGHT SCREENING (IFS) FOR UNITED STATES NAVY AND MARINE CORPS STUDENT PILOTS

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LIST OF ACRONYMS AND ABBREVIATIONS

AETC	Air Education and Training Command
ACES	Aviation Certification Evaluation and Screen
AFB	Air Force Base
API	Aviation Preflight Indoctrination
ASP	Academy Screening Program
ATJ	Aviation Training Jacket
AVDLR	Aviation (fixed wing) Depot Level Repairables
BUPERS	Bureau of Naval Personnel
CETARS	Corporate Enterprise Training Activity Resource System
CI	Confidence Interval
CNATRA	Chief of Naval Air Training
DOR	Drop-on-Request
EFS	Enhanced Flight Screening
FAA	Federal Aviation Administration
FF	Flight Failure
FIP	Flight Instruction Program
FLE	Fraction of Life Expended
FPC	Final Progress Check
FSP	Flight Screening Program
FTS	Flying Training Squadron
FY	Fiscal Year (October 1st to September 30th)

HQ USMC	Headquarters United States Marine Corps
IA	Individual Account
IFS	Introductory Flight Screening
IFT	Introductory Flight Training
IMC	Instrument Meteorological Conditions
IPC	Initial Progress Check
IRAD	Involuntary Release from Active Duty
MIF	Maneuver Item File
MPTS	Multi-Service Pilot Training System
NAS	Naval Air Station
NASC	Naval Aviation Schools Command
NETC	Naval Education and Training Command
NETPDTC	Naval Education and Training Professional Development and Technology Center
NFO	Naval Flight Officer
NITRAS	Navy Integrated Training Resources Administration System
NROTC	Naval Reserve Officer Training Corps
OCS	Officer Candidate School (USN)
OPNAV	Office of the Chief of Naval Operations
OTS	Officer Training School (USAF)
PIP	Pilot Indoctrination Program
POL	Petroleum, Oil, Lubricant
PPC	Private Pilot Certificate

ROI	Return on Investment
ROTC	Reserve Officer Training Corps
SNA	Student Naval Aviator
SNAPPI	Student Naval Aviator Production Planning Information
SRE	Sex, Race, Ethnicity
STASS-Flight	Standard Training Activity Support System Flight
TMS-2	Training Management System 2
TRB	Training Review Board
USAF	United States Air Force
USMC	United States Marine Corps
USN	United States Navy
USNA	United States Naval Academy
UPT	Undergraduate Pilot Training
TW	Training Air Wing
VT	Training Squadron (Fixed Wing)

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I. INTRODUCTION

A. BACKGROUND

Optimizing effectiveness and efficiency is vital for any commercial company to survive in today's competitive market. Efficiency refers to the "capacity to produce results with the minimum expenditure of time, money, or materials." Effectiveness, on the other hand, is defined as "productive of results," goal-accomplishment, and/or adaptation to the external environment (Webster's, 1971). This business philosophy is becoming prevalent in the Department of Defense. The Navy's training command has undergone substantial changes over the past seven years to improve its production process under the guidance of the Thomas Group, Inc and CACI, Inc. Reducing time-to-train and creating a pull-inventory system have been the focus of much attention: "the right student, at the right time". With recent budget allocations funding the War on Terrorism, cost is becoming a critical element in pilot production. Now the concept has been amplified to include cost: "the right student, at the right time, and *at the right price*." Therefore, it is imperative for the Navy to analyze all phases of production to eliminate non-value added processes and improve existing ones.

Attrition is an expensive by-product in pilot production. Introductory Flight Screening (IFS) is a program established to expose Navy and Marine Corps student pilots to aviation in an aircraft at one quarter of the operational expenses of the Navy's Primary training aircraft, the T-34 Turbo Mentor, and nearly one tenth of the T-6 Texan (future T-34 replacement). The objective of IFS is to decrease drop-on-request (DOR) and flight failure (FF) rates in Primary flight training by identifying student pilots who lack the determination, motivation, and aeronautical adaptability required to succeed in training (CNATRA Instruction 3501.1, 2002).

B. PURPOSE

The purpose of this thesis was (1) to investigate the extent to which IFS functions as an effective screening tool and (2) to assess its return on investment (ROI). In the first objective of this thesis, statistical analyses evaluated differences between the non-IFS group (students who did not participate in IFS) and the IFS group (students who did participate in IFS) in DOR and FF rates as well as T-34 flight hours accumulated by the non-graduates. In the second objective, an ROI analysis was completed to determine if savings attributable to IFS in the Primary phase of flight training was greater than the IFS-investment costs. The IFS-investment costs consisted of the direct costs paid to the civilian flight schools for flight training, associated ground school, materials, and instructor costs. The IFS savings consisted of the difference in flying-hour costs and active duty costs between the non-IFS group and the IFS group.

The results from the comparison of non-IFS and IFS attrition rates and T-34 flight hours demonstrated the degree to which IFS is effective in its intention to reduce Primary DOR and FF attrition. The ROI analysis results will show whether the IFS savings is greater than the IFS investment-costs.

C. RESEARCH QUESTIONS

1. Is there a statistically significant difference between the non-IFS and IFS groups in Primary flight training with respect to both DOR and/or FF rates?
2. Is there a statistically significant difference between the non-IFS and IFS groups in Primary flight training with respect to T-34 flight hours for both DOR and/or FF categories?
3. Are cost differences between the IFS group and the non-IFS group greater than the IFS investment?

D. BENEFIT OF STUDY

The benefit of this study is that it will provide the first formal analysis into the effectiveness of the IFS program. This approach will use attrition rates and T-34 flight hours to assess the impact of IFS in Primary flight training and a follow-up ROI analysis will show if IFS is worth its investment. The outcome of this analysis may shape the future of the Naval Aviator production process by providing sound recommendations on the feasibility and/or improvement of the multi-million-dollar IFS program to the Chief of Naval Air Training (CNATRA).

E. SCOPE AND METHODOLOGY

Analyses were conducted on a dataset containing flight outcomes for United States Navy (USN) and United States Marine Corps (USMC) student pilots trained at Navy Primary squadrons utilizing the Primary Multi-Service Pilot Training System (MPTS) syllabus. The study did not include (1) student pilots who bypassed IFS because of prior flight time, (2) Naval Flight Officer (NFO)-to-Pilot transitions, (3) the limited number of USN and USMC student pilots trained at USAF Primary squadrons, (4) students who did not complete the IFS or Primary syllabus because of medical, academic, or administrative reasons, and (5) students who did not complete Aviation Preflight Indoctrination (API). Student pilots not so excluded were examined for the period from FY2002 through FY2004.

The data for this study was extracted from several different sources as follows:

- Navy Integrated Training Resources Administration System (NITRAS).
    - USN, USMC Primary students classified as FF, DOR, or complete.
    - Primary start and end dates.
- Standard Training Activity Support System Flight (STASS-FLIGHT).

    - o Training Air Wing 1of 2: T-34 flight hours for DORs and FFs.
- Training Management System 2 (TMS-2).
    - o Training Air Wing 2 of 2: T-34 flight hours for DORs and FFs.
- Student Naval Aviator Production Planning Information (SNAPPI).
    - o Second source for T-34 flight hours for both Training Air Wings.
- Aviation Training Jacket (ATJ) Summary Cards.
    - o Third source for T-34 flight hours for both Training Air Wings.
- IFS Database at Naval Aviation Schools Command.
    - o IFS students, IFS-investment costs, IFS codes and sub-codes, and IFS students with prior flight time / certificates.

The data was merged and formed into the following groups: IFS-DOR, IFS-FF, Non-IFS Primary-complete, Non-IFS Primary-DOR, Non-IFS Primary-FF, IFS-complete Primary-complete, IFS-complete Primary-DOR, and IFS-complete Primary-FF. Statistical analyses were performed to determine any significant differences in the following comparisons to permit conclusions on the effect of IFS on Primary flight training:

- Rate: Non-IFS Primary-DOR vs. IFS-Complete Primary-DOR.
- Rate: Non-IFS Primary-FF vs. IFS-Complete Primary-FF.
- T-34 Flight hours: Non-IFS Pri-DOR vs. IFS-Complete Pri-DOR.
- T-34 Flight hours: Non-IFS Pri-FF vs. IFS-Complete Pri-FF.

The objective of the ROI analysis was to determine whether the savings yielded by the IFS program justified its investment costs. By definition, IFS non-graduates represent an opportunity-cost savings as they do not remain in the pilot training pipeline following their termination from IFS. For analytic purposes, these individuals were assigned a Primary duration of -60 days, representing the avoided active-duty costs of six weeks of API and two-week entitlement time prior to Primary for each IFS non-graduate. For purposes of calculating flight-

hour costs, these IFS non-graduates were assigned zero T-34 flight hours. These groups were not compared statistically.

The costs of keeping a student on active duty can be measured in many ways. Two considered in this study were composite-pay costs and Individual Account (IA) costs. Composite-pay costs consist of average basic pay, retired-pay accrual, medical-health-care accrual, basic allowance for housing, basic allowance for subsistence, incentive, special pay, permanent change of station pay, and miscellaneous pay. Composite pay costs are broken out by rank. IA costs encompass similar expenses with one important difference: IA costs are averaged for all officers in any type of training environment Navy-wide. Therefore, for purposes of these analyses, IA costs are much greater than composite-pay costs because the students included in this study were mostly O-1’s (USN Ensigns and USMC Second Lieutenants).

In determining the IFS savings, the basic concept was to find the difference between the non-IFS and IFS groups after applying the T-34 flying-hour costs and active-duty costs to the respective attrition rates, mean T-34 flight hours per attrite, and mean Primary duration per attrite. Composite-pay and IA costs were computed separately to provide two different ROI values for consideration. All costs are converted to costs per 1000 pilot starts which is the approximate annual number of USN and USMC pilot accessions. All costs were converted to FY2004 dollars using the U.S. Department of Labor Consumer Price Index for inflation. The IFS-investment costs were the average of the IFS direct expenses (flying hours, ground school, materials, and instructor costs) for all IFS students in this study which were then converted to FY2004 dollars. The IFS-investment costs were subtracted from the total IFS savings to determine the net gain or loss as well as the ROI. For the purpose of this study, ROI equals the IFS savings divided by the IFS investment-costs, i.e., 100% ROI means the savings equal the investment costs.

F. ORGANIZATION OF STUDY

The remainder of the thesis is structured as follows:

- ***Literature Review:*** This chapter discusses the undergraduate pilot training process, Multi-Service Pilot Training System syllabus and grading system, TESCO report, history of introductory flight programs, and a 1987 United States Air Force (USAF) study on the effects of flight screening.

- ***Research Method:*** This chapter details the data process and the analysis methodology.

- ***Data Results and Analysis:*** This chapter discusses the statistical methods used and the results of the analysis of the four non-IFS/IFS comparisons.

- ***ROI Analysis:*** This chapter examines the cost element of the study to determine if IFS is worth its investment.

- ***Conclusion and Recommendations***: This chapter includes the conclusions from the data and ROI analyses, recommendations for the future use and improvement of the IFS program, and areas for further study.

II. LITERATURE REVIEW

A. INTRODUCTION

The purpose of this chapter is to provide an understanding of the context surrounding IFS. The process of producing Naval Aviators from commissioning to completion of undergraduate pilot training (UPT) is explained. In the late 1990s, the Navy revolutionized its syllabus and grading system in an effort to become more *Joint* with the USAF. This new method for training pilots, titled Multi-Service Pilot Training System, is discussed and compared to the former process. Shortly after this system was implemented, the Navy started another new program, IFS, in its quest to improve the effectiveness of pilot training. IFS was one of three recommendations presented by a Navy-contracted consultant team, TESCO. The highlights of the analysis and recommendations from the TESCO report are presented. Next the IFS program and its requirements are stated. The history of introductory flight programs is discussed, but due to limited and poorly documented USN and USMC programs, the focus is on the 50-year history of the USAF programs. Finally, a relevant 1987 USAF flight screening study is discussed.

B. NAVAL AVIATION TRAINING PROCESS

1. Introduction

The U.S. Navy has been training Naval Aviators for nearly 100 years. The training pipeline originally developed has been continually refined to produce Navy pilots with skills sets appropriate for the USN fleet aircraft and threats of their time. The training pipelines have changed little in recent history although the syllabi themselves are reviewed and updated annually.

2. Training Pipeline (Pre-IFS)

All prospective Naval Aviators entering training are commissioned as Naval Officers (with some exceptions). The large majority of these

commissioning sources are the U.S. Naval Academy (USNA), Naval Reserve Officer Training Corps (NROTC), and Officer Candidate School (OCS). All officers must receive a Bachelor's degree while meeting the Navy's requirement for core undergraduate courses. Commissioning is typically coincident with graduation from the USNA and NROTC programs. OCS candidates are commissioned after completion of the thirteen-week program.

During the final year of college for USNA and NROTC Midshipmen and near the end of OCS, students complete their service selection requests for Aviation, Surface Warfare, Submarine Warfare, or Marine Corps. The final decision is based on needs of the Navy, personal performance, and personal preference. All students chosen for aviation-pilot are classified as Student Naval Aviators (SNA) after graduation/commissioning and report to Pensacola, Florida. There the students await the first phase of training, Aviation Preflight Indoctrination (API). Figure 1 displays the Naval Aviator training pipeline.

API is a six-week school consisting of academics, physical fitness, water survival, land survival, and aviation physiology. The academic portion includes aerodynamics, weather, aircraft engines and systems, air navigation, and flight rules and regulations. Physical fitness training includes the Navy Physical Fitness Assessment and general fitness training. Water-survival training teaches students how to survive the multiple hazards following an egress from an aircraft in a water environment. Land survival includes training on the treatment of injuries, building shelters, and finding food and water in the wilderness. Physiology training includes the effects from spatial disorientation due to instrument meteorological conditions (IMC) and night flying (CNATRA Instruction 1542.8J, 2001).

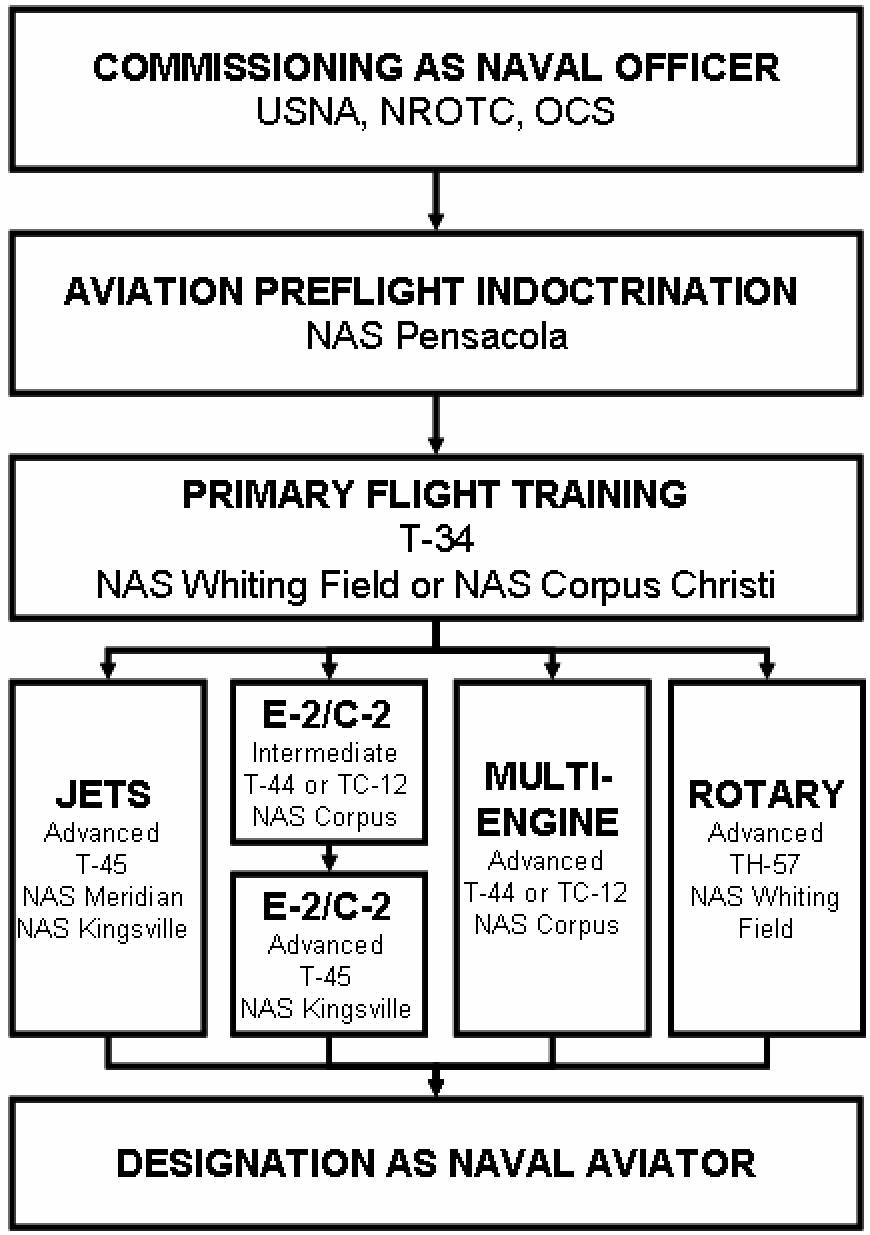

Figure 1. Naval Aviator Training Pipeline.

Following API, all SNAs begin their first phase of flying called Primary. During the six-month Primary-flight-training phase students learn the basics in the T-34 Turbo Mentor (see Figure 2), a high-performance, single-engine, fully-aerobatic, turboprop aircraft. This training is completed in Milton, Florida at Naval

Air Station (NAS) Whiting Field and at NAS Corpus Christi, Texas. Ten percent of the USN and USMC SNAs are trained by the USAF in a Primary-training exchange program. The Primary syllabus includes day and night visual flying, basic and radio instrument flying, day, night, and instrument navigation, and formation stages.

Figure 2. T-34 Mentor (Copyright © of Tony Zeljeznjak, reproduced with permission).

Following the successful completion of Primary flight training, SNAs are selected for one of four advanced training pipelines: jets, E-2/C-2, multi-engine, or helicopters. These selections are based on the needs of the Navy, SNA preferences, and SNA performance. Jet training is completed in the T-45 (see Figure 3) at NAS Meridian, Mississippi and NAS Kingsville, Texas. E-2/C-2 training begins in the T-44 or TC-12 (see Figures 4 and 5) at NAS Corpus Christi and is completed in the T-45 at NAS Kingsville, Texas. Multi-engine training is completed in the T-44 or TC-12 at NAS Corpus Christi. Helicopter training is completed in the TH-57 (see Figure 6) at NAS Whiting Field. Students receive their *wings of gold* and fleet-aircraft assignments upon the successful completion of advanced training when they are officially designated Naval Aviators (CNATRA Instruction 1500.4F, 1999).

Figure 3. T-45 Goshawk (Copyright © of Tony Zeljeznjak, reproduced with permission).

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3. Multi-Pilot Training System

In an attempt to increase the joint-aspect of pilot training, the USN and USAF worked side by side in the acquisition of the T-6 Texan (see Figure 7), an extremely high-performance, single-engine, fully-aerobatic, ejection-seat, turboprop aircraft. Along with this aircraft is the jointly-developed MPTS syllabus. Although the USN deferred the purchase of the T-6 aircraft for several years because of remaining Fraction of Life Expended (FLE) in the T-34, the MPTS syllabus was implemented immediately.

Figure 7. T-6 Texan (Copyright © of Red-Phoenix AirPics, reproduced with permission).

The most significant change accompanying the MPTS syllabus is a radically different grading system that the USAF originally developed. Instead of

the previous system where instructor pilots grade each maneuver as above average, average, below average, or unsatisfactory based on the instructor's personal perspective, the MPTS grading system attempts to remove the subjectivity by establishing performance standards for every maneuver.

With MPTS, Instructor Pilots grade the SNAs according to established performance standards listed in the Primary master curriculum guide. As an example, basic air work has a standard of +/- 100 feet, +/- 10 knots, +/- 10 degrees of heading. Each maneuver is graded from 1 to 5 as shown below:

- 1: *Not graded* (Maneuver is demonstrated by instructor or not observed if flight is solo)
- 2: *Unable* (Maneuver is unsafe or greatly exceed standards)
- 3: *Fair* (Maneuver is safe but deviations exceed standards)
- 4: *Good* (Maneuver meets standards)
- 5: *Excellent* (Maneuver greatly exceeds standards).

The SNA has increased proficiency requirements as he/she progresses through the syllabus. For example, the student may only require a 2 for a particular maneuver in an early stage while a 4 may be the requirement near the end of Primary.

The MPTS syllabus streamlines the process for unsatisfactory events, which in the previous grading system, could take up to three weeks for the required review and recommendations of the chain of command. A delay of this magnitude for a struggling student may create a barrier to his/her success because of the perishable nature of pilot proficiency common to inexperienced aviators.

With MPTS, failure to meet the required proficiency level named Maneuver Item File (MIF) by the end-of-block check-flight requires a re-check. The student is permitted two re-check flights to meet MIF. If the SNA fails to meet

MIF on the third try, he/she requires an Initial Progress Check (IPC). Failure of an IPC requires a Final Progress Check (FPC). Failure of a FPC requires a Training Review Board (TRB) to determine if any special circumstances may have contributed to the SNA's poor performance. The Training Air Wing Commodore makes the final decision at this point on a student's resumption or termination from Primary flight training. This process with MPTS dramatically reduces the time between an unsatisfactory event and the continuation or removal from training compared to the previous system. The USN Primary squadrons began using the MPTS syllabus and grading system in September 1999 (CNATRA Instruction 1542.140C, 2003).

C. THE TESCO REPORT

In October 2000, TESCO, Incorporated, a Navy-contracted consultant group, published a report for the Chief of Naval Air Training titled "Process Improvement in Accession of Prospective Student Naval Aviators." This report was in response to a request from CNATRA to improve its screening process to help lower rising attrition in Primary flight training.

TESCO examined SNA attrition rates from FY1996 to FY2000. TESCO also investigated reasons for attrition with data extracted from training-exit surveys completed by students who were removed from flight training. With this information, TESCO was able to determine the best approach to screen high-risk students in an attempt to reduce attrition in undergraduate pilot training.

TESCO completed an assessment of available screening devices used to measure the attributes leading to success in aviation training classified as psychomotor skills, spatial apperception, and multi-tasking capability. Next, TESCO examined the potential of an introductory flight-screening program to assess a student's aeronautical adaptability, motivation, and determination to become a Naval Aviator. By interpreting USAF introductory flight program data, TESCO inferred that a 25-flight hour program provided the greatest screening per dollar. The USAF Introductory Flight Training (IFT) program utilizes a 50-hour

program with a requirement to earn a Private Pilot Certificate (PPC). Based on the USAF IFT screening rate of 1.4% for both DOR and FF attrition, TESCO expected the same 1.4% screening rate for IFS. After full implementation of IFS, TESCO projected the combined rate of DOR and FF attrition to decrease from 10.0% to 6.2%, a net decrease of 3.8%

After the previously mentioned analyses were completed, TESCO offered three major recommendations: (1) improve the Aviation Selection Test Battery (ASTB), (2) continue the Aviation Certification Evaluation and Screen (ACES) flight indoctrination program, and (3) establish a 25-flight hour Introductory Flight Screening (IFS) program. ACES consisted of a Naval Aerospace Medical Institute (NAMI) flight physical, National Museum of Naval Aviation tour, Air Traffic Control Tower tour, physical fitness indoctrination, swimming indoctrination, T-34 flight, and a flight-line tour. ACES was used as both a recruiting and screening tool. With this three-pronged approach named the Integrated Pre-flight Screening Process, TESCO believed that high-risk students would be sufficiently screened resulting in the lowest feasible Primary attrition rates(TESCO, 2000).

One of TESCO's major arguments to the Commander, Naval Education and Training Command (NETC) in support of IFS was the expectation that the flight exposure provided by IFS would induce students unsuited for aviation to DOR during IFS rather than in later phases of training. Relative to the costs associated with undergraduate pilot training, IFS represents a minimal investment in each student. TESCO argued that a 25-hour program would provide sufficient exposure to induce IFS DORs in students destined to DOR later in training, TESCO did not address the training value potential provided by IFS.[1]

D. INTRODUCTORY FLIGHT SCREENING

TESCO was successful in selling the IFS concept to Vice Admiral Alfred G. Harms Jr., USN (NETC). On December 16, 2002, the CNATRA Chief of Staff,

[1] J.M. Hooper, CNATRA Aviation Psychologist, (personal communication, July 2005).

William H. Carey, signed Instruction 3501.1 titled *Introductory Flight Screening (IFS) Program.* CNATRA used the implementation recommendations outlined in the TESCO report as a framework for the IFS program.

As shown in Figure 8, CNATRA is responsible for the IFS program. Naval Aviation Schools Command (NASC) runs the program with a designated program manager who solicits input from the Bureau of Naval Personnel (BUPERS), Headquarters Marine Corps (HQ USMC), and Office of the Chief of Naval Operations (OPNAV). IFS is executed at participating civilian flight schools located nearby OCS, NROTC, USNA, and USMC training sites around the country. Local IFS military supervisors ensure the proper execution of the IFS program.

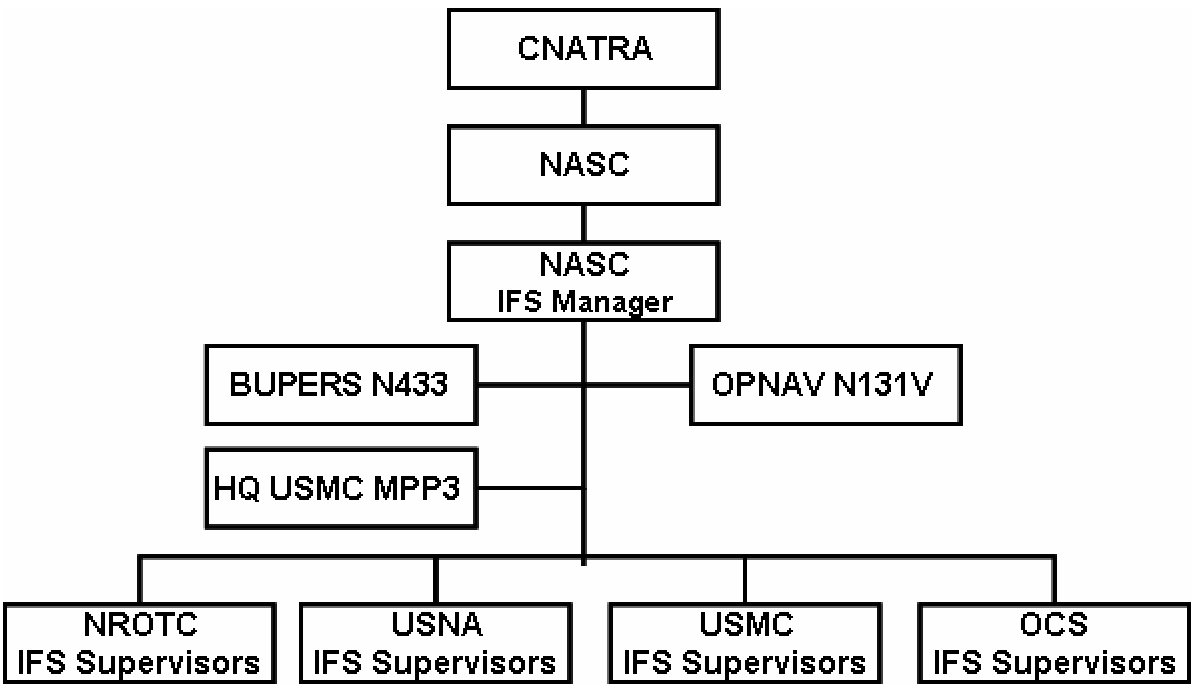

Figure 8. IFS Organization Chart.

The participating civilian flight schools must be FAA Part 141 certified in order to be eligible to participate in IFS. The program consists of 25 flight hours and associated ground instruction. The monitoring of the program is facilitated by a web-based application maintained by the Naval Education and Training Professional Development and Technology Center (NETPDTC) in Pensacola,

Florida. Prospective SNAs who meet all medical, swim, fitness, and anthropometric standards must participate in IFS. Students must complete IFS prior to API and may begin the program prior to service selection if recommended by their unit commanding officer, after service selection during the undergraduate academics, or immediately following graduation.

IFS has several milestones required for successful completion. The SNA must fly at least 24 flight hours, but no more than 25 hours to include three solo flights with one being a cross-country event. The first solo must be flown by the 15-hour mark which can be extended to 17 if the command review board approves. There are additional time-to-train requirements depending on whether the SNA is active in undergraduate academics. If the SNA is unable to meet these requirements, he/she will be removed from pilot training unless a waiver is requested from CNATRA and subsequently approved. SNA-initiated DORs are permitted at any time resulting in the student being removed from pilot training (CNATRA Instruction 3501.1, 2002).

E. HISTORY AND EVOLUTION OF USAF INTRODUCTORY FLIGHT PROGRAMS

The USAF began its first flight screening program in 1953 for USAF Academy Cadets in an attempt to reduce attrition during UPT. The program ranged from 16 to 65 flight hours before being terminated in 1961. The USAF formalized flight screening in 1965 with the acquisition of the T-41 (Cessna 172F), see Figure 9. This Pilot Indoctrination Program (PIP) consisted of a 10-flight hour requirement and an optional 30-flight hour addition. The objectives of this program were to motivate individuals for a career in aviation, to identify students with a high-risk of failure in UPT, and to minimize attrition of USAF Academy Cadets in UPT (Secretary of the Air Force Inspector General, 1998).

Figure 9. T-41 Mescalero (Copyright © of Tony Zeljeznjak, reproduced with permission).

USAF Reserve Officer Training Corps (ROTC) Cadets utilized the Flight Instruction Program (FIP) comprised of a 40-flight hour syllabus initiated in 1956 where students received flight instruction at civilian flight schools. Data showed a significant decrease in Primary attrition rates (25% to 6%) for the FIP students over the non-FIP (Secretary of the Air Force Inspector General, 1998).

The USAF maintained separate and unequal screening/training programs for Academy and ROTC Cadets while the Officer Training School (OTS) candidates had no program. In March 1973 because of high OTS attrition rates (OTS students accounted for 81% of all UPT attrition), OTS candidates began participation in the contractor-run Flight Screening Program (FSP) utilizing the T-41 at Hondo, TX. Until the mid 1980's, the USAF Academy maintained PIP, USAF ROTC continued FIP, and OTS operated under FSP (Secretary of the Air Force Inspector General, 1998).

FIP began several changes between 1985 and 1987 when it decreased to 42 sites, then 13 sites, and finally terminated. The ROTC Cadets began training at Hondo, TX in 1988 where Embry Riddle briefly provided a 14-hour syllabus. This was soon consolidated under the *Del Rio Flying Service* contract at Hondo where ROTC and OTS students began training together (Secretary of the Air Force Inspector General, 1998).

USAF leadership desired to intensify the introductory flight programs to better prepare students for the fast-paced undergraduate training. They were not satisfied with the T-41 because of its limited aerobatic capability. In 1990 the

USAF began the acquisition process of the aerobatic, single-engine propeller T-3 Firefly (see Figure 10). By utilizing a common aircraft, the USAF intended to increase standardization of introductory flight programs for Academy, ROTC, and OTC students. The resulting Enhanced Flight Screening (EFS) program was dual-sited at Hondo, Texas and Colorado Springs, Colorado with the 3rd Flying Training Squadron (FTS) and the 557th FTS respectively (Secretary of the Air Force Inspector General, 1998).

Figure 10. T-3 Firefly. (Copyright © of Simon Thomas, reproduced with permission).

The 3rd FTS and 557th FTS maintained significant differences despite using the same aircraft and syllabus. The 3rd FTS utilized civilian contract instructor pilots while the 557th FTS employed active duty USAF pilots. The 3rd FTS began student screening in July 1994 and the 557th FTS followed suit in January 1995. EFS was short-lived because of three accidents in the T-3 where three instructors and three students from the 557th at the USAF Academy were killed. These accidents occurred in a three-year period which was an alarming rate considering the T-41 suffered no fatal mishaps in its 30 years of service. In July 1997, the T-3 was grounded (Secretary of the Air Force Inspector General, 1998).

Following the grounding of the T-3, attrition rates began to climb to over 15%. USAF leadership brainstormed with several options to find an interim program until the T-3 was ready for training again. In October 1998, the USAF began Introductory Flight Training (IFT) where students received 40 hours of

FAA-certified instruction at over 150 civilian flight schools around the U.S. IFT was uniform for USAF Academy, ROTC, and OTC students (Carretta, 2000).

The purpose of IFT was to provide a temporary fix to reduce rising UPT attrition until the T-3 EFS program was reinstated. On October 8, 1999, an Air Education and Training Command (AETC) news release announced the official end to T-3 operations and the EFS program after over two years of grounding (AETC News Release, 1999).

On January 3, 2000, USAF AETC began an expanded IFT program. IFT was increased to 50 hours because of its success in lowering UPT attrition to 8.8%. This rate was significantly less than the 11.3% UPT attrition rate for T-41-screened pilots and comparable to the 7.8% UPT attrition rate of T-3-screened pilots. Students without any screening had a historical UPT attrition rate of 15.6%. AETC added requirements for students to solo by 25 hours and receive a Private Pilot Certificate (PPC) by 50 hours (USAF Message 291819Z, 1999).

After four years of the expanded IFT program, the USAF Academy decided to change its introductory flight program. Academy leadership was not satisfied with the 50-hour IFT program because the Academy Airfield could not accommodate all Academy pilot recruits. Many were required to complete IFT at other airports after graduation, which led to standardization issues. Moreover, the Academy Superintendent did not feel IFT provided the appropriate skill sets for UPT. In response to these problems, the USAF Academy implemented its own 25-hour Academy Screening Program (ASP) that allowed for all Academy Cadets to train at the Academy Airfield in Colorado Springs (AETC History, 2002-2003).

In 2005, the USAF is transforming its pilot screening process across the board. The new six-week program, Initial Flight Screening, will consist of a 19-sortie, 25-hour flight screening program at a single site run entirely by a civilian contractor with USAF oversight. The contractor is required to provide housing, meals, physical fitness facilities, transportation, ground instruction, flight instruction, training facilities, and aircraft for up to 1800 student pilots per year (Rayko, 2005).

There are several reasons why the USAF senior leadership has decided to return to the single-location screening program. There is a direct correlation between the previous FSP and EFS programs at Hondo and lower undergraduate washout rates. The USAF continues to experience a traditional pilot training attrition rate of 10% but the components of that washout group have shifted significantly toward DORs and away from flight failures. It appears that students with difficulty in training are more inclined to DOR than in past years. One of the drivers for returning to a centralized Initial Flight Screening program is to attempt to identify the potential DORs through a more militarily rigorous program. USAF senior leadership wants military oversight, rigorous flight screening, standardization, and predictive time-to-train. Students will flow through Initial Flight Screening as a class and graduate as a class. The hope is that undergraduate pilot training DOR rates will decrease if those individuals can be identified and eliminated early with a more demanding, military-like screening program.[2]

F. USAF FLIGHT SCREENING STUDY

In August 1987, the USAF published a 4-year study titled, “Flight Screening Program Effects on Attrition in Undergraduate Pilot Training”. This study followed 960 students from FSP to their graduation or termination from UPT. These students were divided into five groups:

- Group I: Did not participate in FSP, allowed direct entry into UPT.
    - Unscreened and untrained.
- Group II: Received extended FSP (20 hours instead of 14).
    - Screened and extra-trained.
- Group III: Normal FSP.
    - Screened and trained.
- Group IV: Normal FSP except students were not screened.
    - Unscreened but trained.

[2] J.S. Harlan, AETC IFT and Initial Flight Screening Action Officer, (personal communication, July 26, 2005).

- Group V: FSP Failures (subset of group IV).
    - o Failed FSP but allowed into entry into UPT.

This study had six Primary research questions to address the effectiveness of FSP:

1. Does FSP have an effect on UPT attrition rates?
2. If FSP does affect attrition rates, is the effect from screening, training or both?
3. If the effect is from screening, does it screen by elimination of FF, or self-initiated DOR, or both?
4. Does FSP confer a training and/or experience benefit?
5. If there is a training/experience effect, would a longer program of FSP flying significantly increase the training/experience benefit?
6. How are lesson grades received in the FPS related to success or failure in UPT? Would a shorter FSP provide adequate prediction of UPT results?

The students in this study were OTS candidates or graduates. FSP was a 14 hour program in the T-41. Each flight was flown by the student and graded by an accompanied Instructor Pilot. Satisfactory grades were required for continuation in the program. After 12 hours of flying, a final evaluation flight was administered. It the student passes this check flight, he/she enters UPT, and if not, a second final evaluation flight is given. If the student fails the second flight he/she is classified as a FSP FF and removed from the pilot training pipeline. Students have the option to DOR at any time during FSP (USAF Manpower and Personnel Division, 1987).

The following are the relevant conclusions from this study:

1. FSP significantly decreased UPT attrition. UPT attrition rates were lower in Group III than Group I.
2. High UPT failure risks can be identified in FSP. However, there was no difference in UPT attrition rates for Group III and Group IV.

3. FSP had no effect on UPT DOR rates. The UPT DOR rate was no higher in Group I than in Group IV.

4. FSP had significant desirable training and experience effects in UPT. UPT attrition rates were lower in Group IV than in Group I.

5. Extension of FSP to 20 hours gave an additional training benefit. UPT attrition rates were lower in Group II than in Group III.

6. Any attempt to predict UPT outcomes at an earlier stage in FSP would result in significant loss of UPT predictive information.

G. SUMMARY

The context of IFS was provided by the discussion in this chapter. The Navy's pilot training process and the MPTS grading system common to all pilots in this study were explained. The details of TESCO report offered the background and recommendation for IFS. The organization of IFS and its requirements were mentioned. To understand the evolution of introductory flight programs, the 50-year history of USAF programs was detailed. Finally, the 1987 USAF flight screening study was presented.

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III. RESEARCH METHOD

A. INTRODUCTION

Data was extracted from several sources to retrieve information on Primary flight students within the scope of this study. Extraneous datapoints were removed and the data extractions were electronically merged forming the final dataset. The methodology for the comparison of the groups using this dataset is discussed. It should be noted that the data for the non-IFS group and the IFS group do not span concurrent time periods. This chapter addresses the first two research questions while the third is examined in the ROI Analysis chapter.

B. RESEARCH DATA

1. Research Questions

a. Is there a (statistically) significant difference between the non-IFS and IFS groups in Primary flight training with respect to both DOR and FF rates?
b. Is there a (statistically) significant difference between the non-IFS and IFS groups in Primary flight training with respect to T-34 flight hours for both DOR and FF categories?
c. Is the net savings between the IFS group and the non-IFS group greater than the IFS investment?

2. Scope

Analyses were conducted on a dataset containing flight outcomes for USN and USMC student pilots trained at Navy Primary squadrons utilizing the MPTS syllabus. The study did not include (1) student pilots who bypassed IFS because of prior flight time, (2) NFO-to-Pilot transitions, (3) the limited number of USN and USMC student pilots trained at USAF Primary squadrons, (4) students who did not complete the IFS or Primary syllabus because of medical, academic, or

administrative reasons, and (5) students who did not complete Aviation Preflight Indoctrination. SNA students not so excluded were examined for the period from FY2002 through FY2004.

Many students bypassed IFS because of prior flight time. Specifically, SNAs who held recreational pilot certificates (or higher) or had completed solo cross-country flights were ineligible to enroll in IFS because of meeting or exceeding program requirements. Students with prior flight time typically complete Primary flight training with significantly higher grades and significantly lower attrition. To avoid any impact from these individuals, they were removed from this study.

Due to their fleet experience, NFOs perform significantly above average with low attrition in Primary similar to students with prior flight time. The extremely small number of NFO-to-Pilot transition students was excluded from this study for the same reason.

Figure 11. T-37 Tweet (Copyright © of Tony Zeljeznjak, reproduced with permission).

In an effort to increase Joint training, USN/USMC and USAF Primary squadrons exchange approximately 100 Primary student pilots annually. The USN/USMC exchange-students are trained at Vance and Moody AFB and fly the T-37 (see Figure 11) and the T-6 (see Figure 7) respectively. The T-6 will eventually replace the T-37 completely. The USAF Primary exchange students

are trained at both NAS Whiting Field and NAS Corpus Christi. Due to differences between USAF and USN training, the USN and USMC exchange students were removed from the scope of this study to reduce the number of variables as much as possible.

This study was limited to DOR and FF attrition directly related to training while flying. There were several other reasons students were unsuccessful in Primary such as: not physically qualified, not aerodynamically adaptable, academic failure, and various types of administrative causes. Student non-graduates with any attrition code other than DOR or FF were removed from the dataset.

The API phase of training does not include any flying events. Therefore the FF code is not applicable. There is, however, attrition due to DORs. Because the scope of this study is attrition related to flying, the DORs in the API phase were excluded.

3. Data Sources

Data sources included NITRAS, STASS-Flight, TMS-2, SNAPPI, IFS Database, and SNA ATJ summary page. NITRAS was the source for Primary non-graduate codes and Primary start/end dates. IFS participants were pulled from the IFS database maintained at NASC. T-34 Flight hours were extracted from STASS-Flight, TMS-2, SNAPPI, and SNA ATJ Summary pages.

The Navy Integrated Training Resources Administrative System (NITRAS) is a database that is provided by the Corporate Enterprise Training Activity Resource System (CETARS). NITRAS is a Navy-wide database that tracks students through all types of training for both officers and enlisted personnel. The data extraction included all USN and USMC SNAs who started Primary flight training on or after October 1st, 2001, completed or terminated Primary flight training on or before September 30th, 2004, and utilized the MPTS curriculum at USN Primary training squadrons. This dataset contained the student's last name, social security number, Primary start date, completion or termination date, and attrition code if applicable. All non-graduates who terminated training for anything

except DOR and FF were removed from the study. Thirty students with uncommon attrition codes were investigated further by examining their ATJ summary cards. Of these 30, six were re-classified as FF for the purpose of this study. The remaining 24 were removed from the dataset.

The IFS data extraction included the student's last name, social security number, IFS start and end dates, IFS code, IFS sub-code, IFS flight hours, and IFS cost of all USN and USMC SNAs who completed or terminated IFS before September 30th, 2004. IFS codes consisted of IFS-C, IFS-V, IFS-F, and IFS-Nongrad. IFS-C (complete) consisted of students who successfully completed IFS. IFS-V (validate) consisted of students who did not meet the requirements for entry into IFS because of prior flight time or FAA pilot certificates. The IFS-V group was removed from the study. IFS-F (failure) consisted of students who failed to complete IFS and had IFS sub-codes of DOR, FF, or not physically qualified (NPQ). The IFS-F NPQ group consisting of 18 students was removed because it was not within the scope of the study. The group classified as IFS-Nongrad consisted of 152 students who did not complete IFS for administrative reasons and were removed from the study. The IFS dataset consisted of IFS-C and IFS-F DOR/FF students.

There are five USN Primary training squadrons. Training Squadron 2, 3, and 6 (VT-2, VT-3, and VT-6) are part of Training Air Wing Five (TW-5) located at NAS Whiting Field. VT-27 and VT-28 are part of TW-4 located at NAS Corpus Christi. TW-5 utilizes the Standard Training Activity Support System Flight (STASS-Flight) database to track students through Primary training including all associated data. TW-4 utilizes the Training Management System 2 (TMS-2) database, completely separate from STASS-Flight. Data was extracted from each of these databases to retrieve T-34 flight hours for all non-graduates within the scope of the study. This non-graduate dataset contained the student's last name, social security number, and T-34 flight hours.

A second source of T-34 flight-hour data used was the Student Naval Aviator Production Planning Information (SNAPPI) database. This non-graduate data extraction included the student's last name, social security number, and T-34 flight hours.

A third source of T-34 flight hours used was the Aviation Training Jacket (ATJ) summary card. The T-34 flight hour data on the ATJ summary was manually pulled from TMS-2/STASS-Flight, SNAPPI, or the student's logbook.

4. Merge of Data

The data extractions from each database were merged into one large dataset. The NITRAS extraction included all Primary-compete students and Primary DOR/FF non-graduates. The IFS-database extraction was used to determine which of the students in the NITRAS dataset participated in IFS. Only the IFS-C and IFS-F DOR/FF individuals in the IFS data extraction were merged with the NITRAS dataset. This merging process was done electronically by comparison of social security numbers. The merged NITRAS/IFS dataset was significantly larger than the initial NITRAS extraction because of a large number of students who participated in IFS, but had not completed or terminated Primary flight training by the end of FY2004. For this reason, all IFS-C students who were not in the NITRAS data extraction were removed from the IFS dataset.

The TMS-2, STASS-flight, and SNAPPI data extractions were merged electronically by comparison of social security numbers with the NITRAS/IFS dataset to add the T-34 flight-hour segment. T-34 flight hours from the ATJ summary card were manually pulled and entered for each SNA non-graduate in the NITRAS/IFS dataset.

5. T-34 Flight Hour Dataset

The comparison of the three different T-34 flight-hour sources yielded several mismatches. CNATRA personnel experienced with these data sources had the most confidence in the SNAPPI database with one exception; it had a early problem where it truncated the values by eliminating the tenths digit and replacing it with zero (e.g., 11.6 became 11.0). TMS-2 and STASS-flight had

several datapoints without any values. The ATJ summary cards provided data for 100% of the non-graduates, however, there was limited consistency between the Training Air Wings on its source (TMS-2/STASS-flight, SNAPPI, or SNA logbooks).

To establish the most reasonable dataset for T-34 flight hours, the following rules were developed. There were a total of 206 Primary non-graduates to which these rules were applied. The number to the right of the rule indicates the number of instances where it pertained.

1. All three sources matched: 49.

2. SNAPPI value matched a second source (either TMS-2/STASS-flight or ATJ summary card): 75.

3. If SNAPPI value ended in a zero and the value in whole hours matched a second source's whole hours, then the second source's value was used (e.g., SNAPPI = 11.0, 2^{nd} source = 11.6, Value used = 11.6): 27.

4. If SNAPPI value was within 5% of second source, then SNAPPI value was used: 13.

With the application of these four rules, 164 datapoints were considered good data and 42 considered bad data. Only the 164 datapoints were used in the statistical analysis for T-34 flight hours, however, all 206 datapoints were used in the rate analysis.

C. METHODOLOGY

The merged dataset was formed into the following groups: IFS-DOR, IFS-FF, Non-IFS Primary-complete, Non-IFS Primary-DOR, Non-IFS Primary-FF, IFS-complete Primary-complete, IFS-complete Primary-DOR, and IFS-complete Primary-FF. Table 1 shows these groups and the total datapoints in each.

To accomplish the first objective of this thesis, the following groups were statistically compared to determine if IFS functioned as an effective screening tool in Primary flight training. The results are discussed in the next chapter.

- Rate: Non-IFS Primary-DOR vs. IFS-Complete Primary-DOR.
- Rate: Non-IFS Primary-FF vs. IFS-Complete Primary-FF.
- T-34 Flight hours: Non-IFS Pri-DOR vs. IFS-Complete Pri-DOR.
- T-34 Flight hours: Non-IFS Pri-FF vs. IFS-Complete Pri-FF.

IFS-Screened Groups		
IFS-DOR	28	
IFS-FF	11	
Total	39	
Non-IFS Groups		
Non-IFS Primary-Complete	1147	
Non-IFS Primary-DOR	80	62 *
Non-IFS Primary-FF	56	36 *
Total	1283	
IFS-Complete Groups		
IFS-Complete Primary-Complete	720	
IFS-Complete Primary-DOR	48	45 *
IFS-Complete Primary FF	22	21 *
Total	790	
* Good T-34 Flight-Hour Data		
Total in Study	2112	

Table 1. Participants by IFS Screening, Non-IFS, and IFS Complete.

D. DATASET TIME SPAN

Sufficient data were not available to permit meaningful comparisons of non-IFS and IFS Primary students over the same time period. For the FY2002-FY2004 period, more non-IFS students came from 2002 and 2003 than did IFS students, and conversely, the majority of the students included in the study for FY2004 were IFS participants (See Figure 12). This is an important limitation to

this study, as it is entirely possible that policy changes/historical events may have affected DOR or FF rates during this period. It may not be possible to separate the simultaneous effects of history from those of the IFS program if both exerted simultaneous, but separate influences on DOR and FF rates.

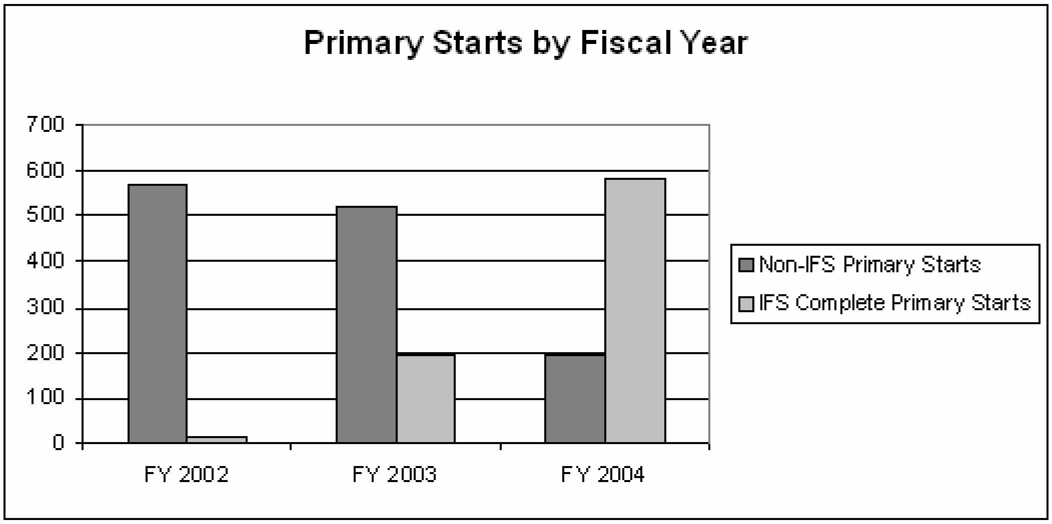


Figure 12. Primary Starts by Fiscal Year.

E. SUMMARY

The data were extracted from several different databases. Any datapoint not within the scope of this study was removed. Next, the data extractions were merged electronically. After the merge additional datapoints were removed because many IFS-complete students had not completed or terminated Primary flight training. Rules were applied to the T-34 flight-hour data to provide the most logical values. This final dataset was the basis for the comparison of the non-IFS and IFS-complete groups. Due to the lack of sufficient data available, the non-IFS and IFS-complete groups did not span the same time period.

IV. DATA RESULTS AND ANALYSIS

A. INTRODUCTION

Chapter four discusses the data analysis required to determine the effect IFS had on Primary flight training with respect to DOR and FF attrition. The results from the following four comparisons are detailed:

- Rate: Non-IFS Primary-DOR vs. IFS-complete Primary-DOR.
- Rate: Non-IFS Primary FF vs. IFS-complete Primary-FF.
- T-34 Flight Hours: Non-IFS Pri-DOR vs. IFS-complete Pri-DOR.
- T-34 Flight Hours: Non-IFS Pri-FF vs. IFS-complete Pri-FF.

Also mentioned are combined IFS DOR and FF screening rates. The statistical methods utilized to test for significance are explained.

B. DATASETS

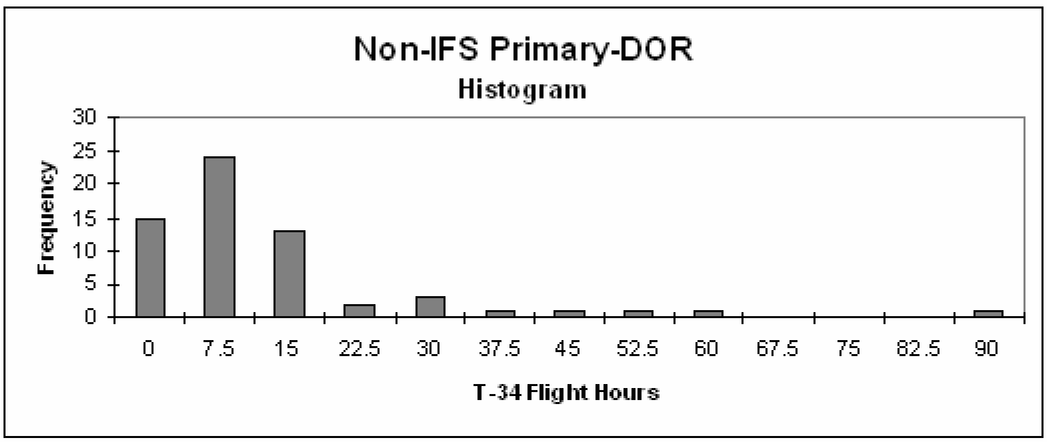
1. Primary Drop-on-Request Datasets

The non-IFS Primary-DOR group consisted of 80 datapoints, but only 62 were considered good T-34 flight-hour data. The non-IFS Primary-DOR mean T-34 flight-hour value was 10.08 with a standard deviation of 15.30. The minimum and maximum values were zero and 85.3 respectively.

The IFS-complete Primary-DOR group consisted of 48 datapoints with 45 considered good T-34 flight-hour data. The IFS-complete Primary-DOR mean T-34 flight-hour value was 18.42 with a standard deviation of 23.14. The minimum and maximum values were zero and 80.4 respectively. The descriptive statistics of these groups are shown in Table 2. The histograms (see Figure 13) show the distribution for both groups, each with a bin size of 7.5.

Non-IFS Primary-DOR T-34 Hours		IFS-Complete Pri-DOR T-34 Hours	
Mean	10.0806	Mean	18.4178
Standard Error	1.9432	Standard Error	3.4501
Median	5.15	Median	6.9
Mode	0	Mode	0
Standard Deviation	15.3011	Standard Deviation	23.1437
Sample Variance	234.1245	Sample Variance	535.6301
Kurtosis	10.0076	Kurtosis	0.7222
Skewness	2.8940	Skewness	1.4105
Range	85.3	Range	80.4
Minimum (1)	0	Minimum (1)	0
Maximum (1)	85.3	Maximum (1)	80.4
Count	62	Count	45

Table 2. Statistics for Primary Drop-on-Request Groups of T-34 Flight Hours.



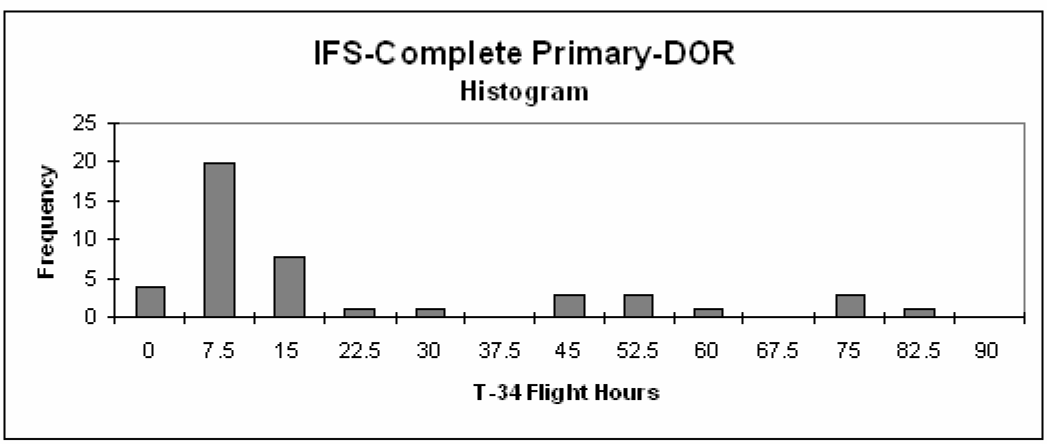


Figure 13. Primary Drop-on-Request T-34 Flight-Hour Histograms.

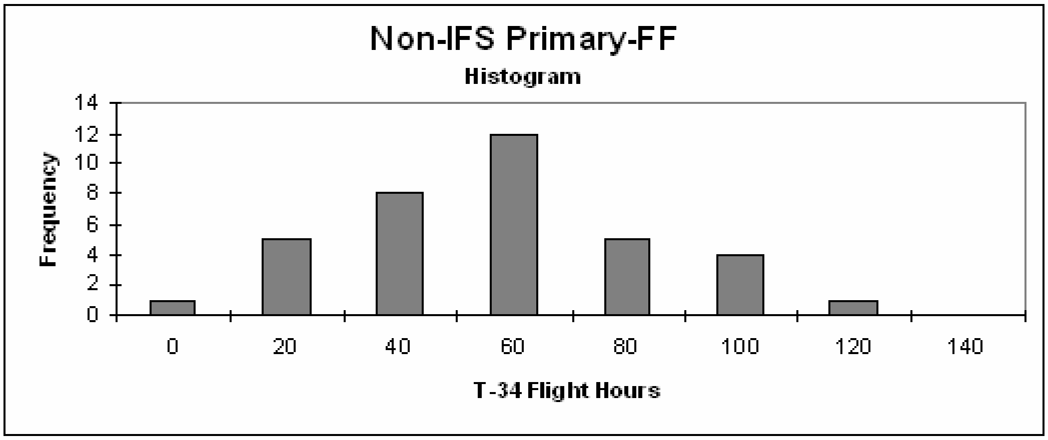
2. Primary Flight-Failure Datasets

The non-IFS Primary-FF group consisted of 56 datapoints, but only 36 were considered good T-34 flight-hour data. The non-IFS Primary-FF mean T-34 flight-hour value was 48.71 with a standard deviation of 26.05. The minimum and maximum values were zero and 117.2 respectively.

The IFS-complete Primary-FF group consisted of 22 datapoints with 21 considered good T-34 flight-hour data. The IFS-complete Primary-FF mean T-34 flight-hour value was 55.73 with a standard deviation of 28.03. The minimum and maximum values were 9.9 and 120.4 respectively. The descriptive statistics of these groups are shown in Table 3. The histograms (see Figure 14) show the distribution for both groups, each with a bin size of 20.

Non-IFS Primary-FF T-34 Hours		IFS-Complete Pri-FF T-34 Hours	
Mean	48.7056	Mean	55.7333
Standard Error	4.3418	Standard Error	6.1175
Median	47.65	Median	47.2
Mode	#N/A	Mode	#N/A
Standard Deviation	26.0508	Standard Deviation	28.0341
Sample Variance	678.6451	Sample Variance	785.9123
Kurtosis	0.3396	Kurtosis	0.3724
Skewness	0.3583	Skewness	0.9108
Range	117.2	Range	110.5
Minimum (1)	0	Minimum (1)	9.9
Maximum (1)	117.2	Maximum (1)	120.4
Count	36	Count	21

Table 3. Statistics for Primary Flight-Failure Groups of T-34 Flight Hours.



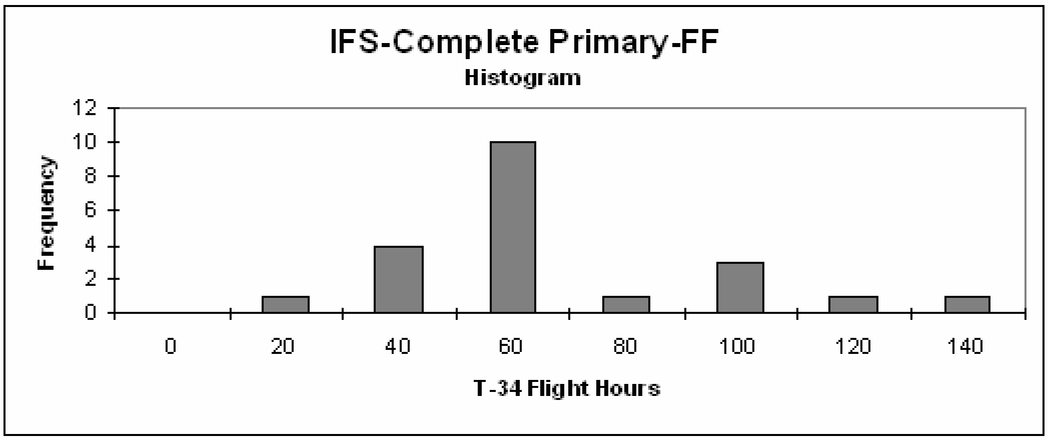


Figure 14. Primary Flight-Failure T-34 Flight-Hour Histograms.

C. RESULTS

1. Confidence Intervals for Proportions

To analyze the attrition rates, a statistical test for significance was performed. The test established confidence intervals for the proportions. With this test, it can be determined whether, for example, the non-IFS Primary-DOR attrition rate is significantly different from the IFS-complete Primary-DOR attrition rate.

In the determination of significance, several calculations are required. The sample size, n, is the number of students who started Primary flight training for either the non-IFS or IFS-complete groups. The number of non-graduates per

group (i.e., non-IFS Primary-DOR) is *x*. The proportion, *p*, is *x* divided by *n*. The formula for the proportion, commonly known as the attrition rate, follows:

$$p = \frac{x}{n}.$$

To calculate the confidence interval (CI) around a proportion, the standard deviation, σ, is needed. The equation for σ which is calculated for only the non-IFS groups because it is with these groups where the confidence intervals are established follows:

$$\sigma = \sqrt{\frac{(p(1-p)}{n}}.$$

To compute the confidence interval, the standard normal deviate, z, is assigned a value of 1.96. This value of 1.96 is found in the cumulative normal probability Table corresponding to the confidence interval of 95%. By adding or subtracting the quantity *z* times σ to *p,* the upper (*UL*) and lower limit (*LL*) values of the 95% CI are calculated for the non-IFS groups as follows:

$$UL = p + z\sigma.$$

$$LL = p - z\sigma.$$

The *p* values for the IFS-complete groups are measured against the non-IFS 95% confidence limits. If $p_{\text{IFS-complete}}$ is within the non-IFS *UL* and *LL* as shown, the difference is non-significant as follows:

$$UL_{Non\text{-}IFS} > p_{IFS\text{-}complete} > LL_{Non\text{-}IFS.}$$

If $p_{\text{IFS-complete}}$ is outside of the non-IFS *UL* and *LL*, the difference is significant, as follows (Hayes, 1994):

$$UL_{Non\text{-}IFS} < p_{IFS\text{-}complete} \quad OR \quad p_{IFS\text{-}complete} < LL_{Non\text{-}IFS.}$$

2. Comparison of Primary DOR Rates

The non-IFS Primary-DOR rate was 6.24%, while the IFS-complete Primary-DOR rate was 6.08%. This difference (0.16%) was found to be non-significant using a 95% confidence interval, meaning that based on the amount of data available, there was insufficient statistical basis for assuming the stability or replication of this difference over time.

3. Comparison of Primary FF Rates

The non-IFS Primary-FF rate was 4.36%, while the IFS-complete Primary-FF rate was 2.78%. This difference was found to be significant using the same test described above: Primary-FF rate in the IFS-complete group was significantly lower (1.58%).

4. Comparison of Combined Primary DOR and FF Rates

Among Primary non-graduates, the combined DOR and FF rate for non-IFS students was 10.60%, while the combined DOR and FF rate from the IFS-complete group was 8.86%. This difference was found to be statistically significant: Primary DOR and FF rate in the IFS-complete group was significantly lower (1.74%). Table 4 shows the values calculated in the rate analysis.

	p	σ	$z\sigma$	UL	LL	Significant?
Non-IFS Pri-DOR	0.062	0.007	0.013	0.076	0.049	No
IFS-Cmplt Pri-DOR	0.061					
Non-IFS Pri-FF	0.044	0.007	0.014	0.058	0.029	Yes
IFS-Complete Pri-FF	0.028					
Non-IFS Pri-DOR and FF	0.106	0.009	0.017	0.123	0.089	Yes
IFS-Cmplt Pri-DOR and FF	0.089					

Table 4. Results of Confidence Interval Tests

5. Statistical Test for Comparison of T-34 Flight Hours

The statistical method used to evaluate the T-34 flight-hour differences between the non-IFS and IFS-complete Primary groups was a two-tailed pooled-

variance t-test. The t-test compares the means of two groups and can be used with small sample sizes. The two-tailed variety was utilized because results at both ends of the spectrum are of interest due to the lack of an anticipated result. A 95% confidence factor was used requiring *p* to be less than .05 meaning the difference was statistically significant (Hayes, 1994).

6. Comparison of T-34 Flight Hours for Primary DOR Groups

T-34 flight hours used by non-IFS Primary-DOR and IFS-complete Primary-DOR groups were compared using the described method. Mean hours used by non-IFS Primary-DORs were 10.08, while for IFS-complete Primary-DORs, mean flight hours were 18.42. This difference of 8.34 flight hours was statistically significant because the *p* value of .027 was less than .05 (see Table 5).

Primary DOR T-34 Flight Hour T-test Results	
Pooled Variance	360.4697
df	105
t Stat	-2.2423
P(T ≤ t) two-tail	0.0270
t Critical two-tail	1.9828
t(105) = 2.24; sig; *p* = .027	

Table 5. Results of Two-Tailed T-test for Primary-DOR T-34 Flight Hours

7. Comparison of T-34 Flight Hours for Primary FF Groups

A similar comparison of T-34 flight hours used by non-IFS and IFS-complete Primary FF groups was made. Mean flight hours for non-IFS Primary-FF were 48.71, while mean hours for the IFS-complete Primary-FF group were 55.73. This difference of 7.02 flight hours was not found to be significant because *p* had a value of .34 which is greater than .05. This means that based on the amount and variability of the data available for this study, there was insufficient evidence to suggest the ability to replicate this finding (see Table 6).

Primary FF T-34 Flight Hour T-test Results	
Pooled Variance	717.6514
df	55
t Stat	-0.9554
P(T ≤ t) two-tail	0.3436
t Critical two-tail	2.0040
$t(55) = .955$; ns; $p = .34$	

Table 6. Results of Two-Tailed T-test for Primary FF T-34 Flight Hours

8. IFS Screening Rates

Although not germane to the previous analysis, but of possible interest, are the screening rates of IFS. The DOR screening rate of IFS was 3.38% and the FF screening rate of IFS was 1.33%.

D. SUMMARY

The first objective of this thesis was to determine the impact IFS had on Primary flight training by answering the first two research questions relating to the attrition rate and T-34 flight-hour comparisons. A summary of the analysis results is presented in Table 7.

IFS Screening			
	DOR	FF	DOR and FF
Screening Rate	3.38%	1.33%	4.70%
Primary DOR			
	Non-IFS	IFS-Complete	Difference
Attrition Rate	6.24%	6.08%	0.16%
T-34 hours	10.08	18.42	- 8.34 *
Primary FF			
	Non-IFS	IFS-Complete	Difference
Attrition Rate	4.36%	2.78%	1.58% *
T-34 hours	48.71	55.73	- 7.02
Primary DOR and FF			
	Non-IFS	IFS-Complete	Difference
Attrition Rate	10.60%	8.86%	1.74% *
* Indicates difference is statistically significant			

Table 7. Summary of Results.

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V. ROI ANALYSIS

A. INTRODUCTION

The second objective of this thesis is to complete a return-on-investment analysis. This addresses the third research question: Is the net savings between the IFS group and the non-IFS group greater than the IFS investment? In the determination of whether the savings yielded by the IFS program justified its investment, T-34 flying-hour, active-duty, and IFS-investment costs were examined. This ROI analysis modified the original dataset to account for students screened in IFS. There were several calculations involved in this analysis which are explained in detail.

B. ROI DATASETS

By definition, IFS non-graduates represent an opportunity-cost savings as they do not remain in the pilot training pipeline following their termination from IFS. It is assumed that an IFS failure is a future Primary failure. For analytic purposes, these individuals were assigned a Primary duration of -60 days, representing the avoided active duty costs of six weeks of API and two-week entitlement time prior to Primary for each IFS non-graduate. For purposes of calculating flight hour costs, these IFS non-graduates were assigned zero T-34 flight hours. With this modification to the applicable datapoints, IFS-screened students were folded into the IFS-complete Primary group to form a single IFS group. Added to the dataset was the duration of Primary flight training for each non-graduate. The non-IFS group and IFS group were not compared statistically. The groups’ size, mean T-34 flight hours per attrite and mean Primary duration per attrite is shown in Table 8.

	Non-IFS Group	IFS Group
IFS DORs	NA	28
Primary DORs	80	48
Total DORs	80	76 *
IFS FFs	NA	11
Primary FFs	56	22
Total FFs	56	33 *
Primary-Complete Students	1147	720
Student Starts in Training	1283	829
Mean T-34 Flight Hours Per DOR	10.08	11.35 *
Mean Days in Primary Per DOR	99.13	37.99 *
Mean T-34 Flight Hours Per FF	48.71	36.58 *
Mean Days in Primary Per FF	164.32	85.76 *
* Includes IFS-screened DORs and FFs assigned 0 T-34 Flight Hours and - 60 Days for Primary Duration		

Table 8. ROI Analysis Dataset.

C. ROI COSTS

1. Conversion to FY2004 Dollars

All costs utilized in this study were converted to FY2004 dollars using the U.S. Department of Labor's Consumer Price Index for inflation to allow for comparison between years. An inflation rate was applied to the FY2002 and FY2003 costs adjusting them to FY2004 equivalent values. The calculation for the inflation from FY2002 to FY2004 (similarly for FY2003 to FY2004) is:

$$Inflation\ FY2002\ to\ FY2004 = \frac{FY2004\ CPI\ ave - FY2002\ CPI\ ave}{FY2002\ CPI\ ave}.$$

The inflation rate from FY2002 to FY2004 is 4.72% and from FY2003 to FY2004 is 2.32%, see Table 9 (U.S. Department of Labor: Bureau of Labor Statistics, 2005).

	Monthly CPI												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Average
FY02	177.7	177.4	176.7	177.1	177.8	178.8	179.8	179.8	179.9	180.1	180.7	181.0	178.9
FY03	181.3	181.3	180.9	181.7	183.1	184.2	183.8	183.5	183.7	183.9	184.6	185.2	183.1
FY04	185.0	184.5	184.3	185.2	186.2	187.4	188.0	189.1	189.7	189.4	189.5	189.9	187.4
												FY02 to FY04	4.72%
												FY03 to FY04	2.32%

Table 9. U.S. Consumer Price Index and Inflation.

2. Weighting Factors

Primary flight students frequently crossed over fiscal years during training. For the purpose of this study, each student was classified in a specific fiscal year based on when the majority of his/her Primary training was completed. This was determined by finding what fiscal year the midpoint in training occurred. The IFS-screened students of the IFS group were assigned a fiscal year based the termination date from IFS. Table 10 shows the count of students by fiscal year for both non-IFS and IFS groups. Using these counts, weighting factors were established, also shown in Table 10. These weighting factors were used to calculate mean flying-hour and active-duty costs in FY2004 dollars.

	Non-IFS	Non-IFS Weight	IFS	IFS Weight
FY02	92	0.6765	8	0.0734
FY03	36	0.2647	40	0.3670
FY04	8	0.0588	61	0.5596

Table 10. Non-IFS and IFS Group Weighting Factors.

Composite-pay Tables have separate USN and USMC active-duty costs. Table 11 shows counts and weighting factors by service in their respective non-IFS/IFS groups.

	USN		USMC		USN		USMC	
	Non-IFS	Weight	Non-IFS	Weight	IFS	Weight	IFS	Weight
FY02	73	0.53676	19	0.13971	5	0.04587	3	0.027523
FY03	22	0.16176	14	0.10294	36	0.33028	4	0.036697
FY04	3	0.02206	5	0.03676	50	0.45872	11	0.100917

Table 11. Non-IFS and IFS Group Weighting Factors for USN and USMC.

3. T-34 Flying-Hour Costs

The T-34 cost per hour was fully burdened meaning it included: petroleum, oils, and lubricants (POL), aviation depot level repairables (AVDLR), fixed and variable cost contracts including parts and material, and other aviation related items (i.e. flight gear, etc).[3]

The T-34 cost per hour in its occurring fiscal year dollars was multiplied by the appropriate inflation rate resulting in FY2004 dollar values.[4] These costs were then multiplied by their respective non-IFS and IFS weights from Table 10. Next, the products were summed to determine the non-IFS and IFS group mean T-34 cost per hour. The mean T-34 cost per hour was $364.19 for the non-IFS group and $383.08 for the IFS group in FY2004 dollars (see Table 12).

	Cost/ hour	Conversion to FY04	Constant year $	Non-IFS Weight	IFS Weight	Non-IFS	IFS
FY02	$340.95	1.0472	$357.05	0.6765	0.0734	$241.54	$26.21
FY03	$367.99	1.0232	$376.53	0.2647	0.3670	$99.67	$138.18
FY04	$390.78	1	$390.78	0.0588	0.5596	$22.99	$218.69
					Mean T-34 Cost / hour	$364.19	$383.08

Table 12. Calculation of Mean T-34 Flight Hours for Non-IFS and IFS

4. Active-Duty Costs

The costs of keeping a student on active duty can be measured in many ways. Two considered in this study were composite-pay costs and Individual

[3] A.R. Owens, CNATRA N52, Production Flight Hour Manager, (personal communication, April 2005).

[4] A.R. Owens, CNATRA N52, provided T-34 flight-hour cost data.

Account costs. Composite-pay costs consist of average basic pay, retired-pay accrual, medical-health-care accrual, basic allowance for housing, basic allowance for subsistence, incentive, special pay, permanent change of station pay, and miscellaneous pay (see Tables in Appendix B). Composite pay costs are broken out by rank (Department of Defense FY2002-FY2004 Reimbursable Rates, 2005).

Individual Account costs encompass similar expenses with one important difference: IA costs are averaged for all officers in any type of training environment Navy-wide.[5] Therefore, for purposes of these analyses, IA costs are much greater than composite-pay costs because the students included in this study were mostly O-1's (USN Ensigns and USMC Second Lieutenants).

The active-duty cost per day was calculated similarly to T-34 cost per hour. The composite-pay costs were extracted from the Department of Defense Reimbursable Rate Tables in Appendix B. These costs were converted to FY2004 dollars using the appropriate inflation rates and then multiplied by their respective USN and USMC weighting factors from Table 11 to calculate the mean non-IFS and IFS composite-pay costs per year. The mean composite pay cost per year was $60,112.96 for the non-IFS group and $66,333.71 for the IFS group in FY2004 dollars (see Table 13).

[5] J. Arend, OPNAV FOB2, 2608, (personal communication, May 5, 2005).

USN	Composite Pay / Year	Conversion to FY04	Constant Yr $	Non-IFS Weight	IFS Weight	Non-IFS	IFS
FY02	$57,002.00	1.04723309	$59,694.38	0.53676	0.04587	$32,041.84	$2,738.27
FY03	$67,406.00	1.02321136	$68,970.58	0.16176	0.33028	$11,157.01	$22,779.28
FY04	$67,604.00	1	$67,604.00	0.02206	0.45872	$1,491.26	$31,011.01
USMC	Composite Pay / Year	Conversion to FY04	Constant Yr $	Non-IFS Weight	IFS Weight	Non-IFS	IFS
FY02	$52,656.00	1.04723309	$55,143.11	0.13971	0.02752	$7,703.82	$1,517.70
FY03	$51,280.00	1.02321136	$52,470.28	0.10294	0.0367	$5,401.35	$1,925.51
FY04	$63,041.00	1	$63,041.00	0.03676	0.10092	$2,317.68	$6,361.94
					Mean Composite Pay Cost / Year	$60,112.96	$66,333.71

Table 13. Mean Composite-Pay Costs for Non-IFS and IFS Groups.

The IA active duty cost per year for FY2002, FY2003, and FY2004 are $101,192.00, $112,832, and $113,716.00 respectively.[6] The mean IA costs were determined in same manner as mean composite-pay costs. The mean IA costs per year were $108,936.41 for the non-IFS group and $113,784.30 for the IFS group in FY2004 dollars (see Table 14).

	Composite Pay / Yr	Conversion to FY04	Constant Yr $	Non-IFS Weight	IFS Weight	Non-IFS	IFS
FY02	$101,192.00	1.04723309	$105,971.61	0.676471	0.073394	$71,686.68	$7,777.73
FY03	$112,832.00	1.02321136	$115,450.98	0.264706	0.366972	$30,560.55	$42,367.33
FY04	$113,716.00	1	$113,716.00	0.058824	0.559633	$6,689.18	$63,639.23
					Mean IA Cost / Year	$108,936.41	$113,784.30

Table 14. Calculation of Mean Individual Account Costs.

5. IFS-Investment Costs

The IFS-investment costs utilized in this study were only those directly related to flight training. They included the costs paid to the civilian flight schools consisting of required ground school instruction, materials, flight instruction, and

[6] J. Arend, OPNAV FOB2, 2608, provided data on historical Individual Account cost data.

aircraft rental costs. These costs were extracted from the IFS database maintained by the Naval Aviation Schools Command.

IFS-investment costs varied significantly across the more than 100 civilian flight schools nation-wide. The mean IFS-investment cost per start was determined by calculating the mean for all IFS students (including those who were screened). However, only 651 of the total 829 IFS datapoints had associated costs. This is because at the start of the IFS program, some students' IFS-investment costs were paid in a group lump sum instead of individually.[7] It was assumed that the 651 nation-wide IFS students would provide a reasonable dataset to determine the mean costs. The 651 IFS students were classified into a fiscal year based on when the majority of their IFS training occurred. The IFS-investment costs were then converted to FY2004 dollar values. The mean was calculated for the IFS-investment costs of the 651 students which resulted in $3439.82 per IFS start (see Table 15).

Mean	3439.8184
Standard Error	21.9420
Median	3295.8661
Mode	2876.1210
Standard Deviation	559.8424
Sample Variance	313423.5056
Kurtosis	-1.0940
Skewness	0.5307
Range	2496.8910
Minimum	2344.1266
Maximum	4841.0176
Count	651

Table 15. IFS-Investment Cost Data.

D. ROI METHODOLOGY

To calculate the net gain or loss and the return on investment, both the IFS savings and the IFS-investment costs must be determined. The mean IFS-

[7] K.S. Rietz, Naval Aviation Schools Command, IFS Officer, (personal communication, April 2005).

investment cost per start was calculated as explained in the preceding paragraph. The methodology for computing the IFS savings is explained next.

The basic concept for determining the IFS savings was to find the difference between the non-IFS and IFS groups after applying the T-34 flying-hour costs and active-duty costs to the respective attrition rates, mean T-34 flight hours per attrite, and mean Primary duration per attrite.

The IFS savings was determined through several calculations. In order to determine the IFS savings, the T-34 flying hour cost per attrite, active-duty cost per attrite, and attrite cost per start were computed. For brevity, *attrite* was substituted in place of DOR/FF and *active-duty* for composite-pay/Individual Account. The T-34 flight hour cost per attrite was calculated as follows:

$$T34\ Cost / Attrite = (T34\ Hours / Attrite) \times (T34\ Cost / Hr)\,.$$

For the calculation of the active-duty cost per attrite, a conversion factor was used to change years to days as follows:

$$Active\ Duty\ Cost / Attrite = (Primary\ Duration / Attrite)\,\frac{Active\ Duty\ Cost / Yr}{365}\,.$$

The total cost per attrite was the sum of the previous two calculations as follows:

$$Total\ Cost / Attrite = (T34\ Cost / Attrite) + (Active\ DutyCost / Attrite)\,.$$

The number of starts was the sum of attrites and completers as follows:

$$Starts = (\#\ of\ \ Attrites) + (\#\ of\ \ Primary\ Completers)\,.$$

The attrite cost per start was calculated as follows:

$$Attrite\ Cost / Start = \frac{(\#\ of\ \ Attrites) \times (Cost / Attrite)}{Starts}\,.$$

The total savings per 1000 starts was calculated by finding the difference between the non-IFS and IFS attrite costs per starts and dividing by 1000 as follows:

$$Savings / 1000\ Starts = \frac{(Non\ IFS\ \ Attrite\ Cost / Start - IFS\ \ Attrite\ Cost / Start)}{1000}\,.$$

The preceding calculations used to determine the IFS savings were completed for the following comparisons:

- Non-IFS DOR vs. IFS DOR using composite-pay costs.
- Non-IFS DOR vs. IFS DOR using IA costs.
- Non-IFS FF vs. IFS FF using composite-pay costs.
- Non-IFS FF vs. IFS FF using IA costs.

Composite-pay and IA costs were computed separately to provide for two different net savings/loss and ROI values for consideration. Positive values indicated a savings and negative numbers signified a loss. All costs were converted to costs per 1000 pilot starts which is the approximate annual number of USN and USMC pilot accessions.

To determine the net gain or loss, the mean IFS-investment costs per 1000 starts were subtracted from the total IFS savings per 1000 starts as follows:

$$Net\ Gain/Loss = IFS\ Savings - IFS\ Investment\ Costs\ .$$

For the purpose of this study, ROI equaled the IFS savings per 1000 starts divided by the IFS-investment costs per 1000 starts (i.e., 100% ROI meant the savings equaled the investment costs). The formula follows:

$$ROI = \frac{IFS\ Savings}{IFS\ Investment\ Costs}\ .$$

E. ROI ANALYSIS RESULTS

1. Inputs for IFS Savings Calculations

The calculation of T-34 flying-hour cost per attrite, active-duty cost per attrite, attrite cost per start, and savings per 1000 starts required several inputs of previously discussed data. The required inputs were consolidated into Table 16.

	Non-IFS Group	IFS Group
Primary Complete	1147	720
Number of Drop-on-Requests	80	76 *
Mean T-34 Flight Hours/DOR	10.08	11.35 *
Mean Pri Duration/DOR (Days)	99.13	37.99 *
Number of Flight Failures	56	33 *
Mean T-34 Flight Hours/FF	48.71	36.58 *
Mean Pri Duration/FF (Days)	164.32	85.76 *
Mean T-34 Cost/Hour	$364.19	$383.08
Mean Composite-Pay Cost/Year	$60,112.96	$66,333.71
Mean IA Cost/Year	$108,936.41	$113,784.30
* Includes IFS-screened DORs and FFs assigned 0 T-34 Flight Hours and - 60 Days for Primary Duration		

Table 16. Inputs for IFS-Savings Calculations.

2. IFS Savings Due to Drop-on-Requests

The T-34 flying-hour cost per DOR was $3,671.31 for the non-IFS group and $4,349.22 for the IFS group. The composite-pay cost per DOR was $16,325.20 for non-IFS and $6,903.58 for IFS. The total cost per DOR was $19,996.51 for non-IFS and $11,252.81 for IFS. The DOR cost per start was $1,303.77 for non-IFS and $1,074.39 for IFS yielding a savings per 1000 starts of $229,377.01. The calculations for IFS savings due to drop-on-requests are shown in the top half of Table 17.

Composite-Pay Costs												
	DOR #	SNA Completers	SNA Starts	Hours /DOR	T-34 Cost/Hr	Flight Hour Cost/DOR	Primary Duration /DOR	Composite Cost/Day	Composite Cost/DOR	Total Costs/DOR	DOR Costs/ Start	Savings /1000 Starts
Non-IFS	80	1147	1227	10.08	$364.19	$3,671.31	99.13	$164.69	$16,325.20	$19,996.51	$1,303.77	$229,377.01
IFS	76	720	796	11.35	$383.08	$4,349.22	37.99	$181.74	$6,903.58	$11,252.81	$1,074.39	

Individual-Account Costs												
	DOR #	SNA Completers	SNA Starts	Hours /DOR	T-34 Cost/Hr	Flight Hour Cost/DOR	Primary Duration /DOR	IA Cost/Day	IA Cost/DOR	Total Costs/DOR	DOR Costs/ Start	Savings /1000 Starts
Non-IFS	80	1147	1227	10.08	$364.19	$3,671.31	99.13	$298.46	$29,584.44	$33,255.75	$2,168.26	$622,374.66
IFS	76	720	796	11.35	$383.08	$4,349.22	37.99	$311.74	$11,841.93	$16,191.16	$1,545.89	

Table 17. IFS Savings per 1000 Starts Based on Drop-on-Requests.

Using Individual Account costs had no effect on the T-34 flying-hour costs per DOR. The IA cost per DOR was $29,584.44 for the non-IFS group and $11,841.93 for the IFS group. The total cost per DOR was $33,255.75 for non-IFS and $16,191.16 for IFS. The DOR cost per start was $2,168.26 for non-IFS and $1,545.89 for IFS yielding a savings per 1000 starts of $622,374.66. The calculations for IFS savings due to drop-on-requests are shown in the lower half of Table 17.

3. IFS Savings Due to Flight Failures

The T-34 flying-hour cost per FF was $17,738.26 for the non-IFS group and $14,011.00 for the IFS group. The composite-pay cost per FF was $27,062.60 for non-IFS and $15,585.26 for IFS. The total cost per FF was $44,800.86 for non-IFS and $29,596.26 for IFS. The FF cost per start was $2,085.49 for non-IFS and $1,297.05 for IFS yielding a savings per 1000 starts of $788,445.79. The calculations for IFS savings due to flight failures are shown in the top half of Table 18.

Composite-Pay Costs

	FF #	SNA Completers	SNA Starts	Hours /FF	T-34 Cost/Hr	Flight Hour Cost/FF	Primary Duration /FF	Composite Cost/Day	Composite Cost/FF	Total Costs/FF	FF Costs/ Start	Savings /1000 Starts
Non-IFS	56	1147	1203	48.71	$364.19	$17,738.26	164.32	$164.69	$27,062.60	$44,800.86	$2,085.49	$788,445.79
IFS	33	720	753	36.58	$383.08	$ 14,011.00	85.76	$181.74	$15,585.26	$29,596.26	$1,297.05	

Individual-Account Costs

	FF #	SNA Completers	SNA Starts	Hours /FF	T-34 Cost/Hr	Flight Hour Cost/FF	Primary Duration /FF	IA Cost/Day	IA Cost/FF	Total Costs/FF	FF Costs/ Start	Savings /1000 Starts
Non-IFS	56	1147	1203	48.71	$364.19	$17,738.26	164.32	$298.46	$49,042.70	$66,780.96	$3,108.67	$1,323,041.10
IFS	33	720	753	36.58	$383.08	$ 14,011.00	85.76	$311.74	$26,733.88	$40,744.88	$1,785.63	

Table 18. IFS Savings per 1000 Starts Based on Flight Failures.

Using Individual Account costs had no effect on the T-34 flying-hour costs per FF. The IA cost per FF was $49,042.70 for the non-IFS group and $26,733.88 for the IFS group. The total cost per FF was $66,780.96 for non-IFS and $40,744.88 for IFS. The FF cost per start was $3,108.67 for non-IFS and $1,785.63 for IFS yielding a savings per 1000 starts of $1,323,041.10. The calculations for IFS savings due to flight failures are shown in the lower half of Table 18.

4. IFS Net Savings (or Loss) and ROI

With composite-pay costs, the total IFS savings was $ 1,017,822.80 per 1000 starts. IFS-investment costs per 1000 starts were $3,439,818.39. By this metric, IFS generated a net loss of $2,421,995.59 per 1000 starts and a 29.59% ROI.

With Individual Account costs in lieu of composite pay costs, the total IFS savings was $1,945,415.76 per 1000 starts. This metric yielded a net loss of $1,494,402.63 per 1000 starts and a 55.56% ROI. Table 19 shows the results of the ROI analysis.

	IFS Savings from DORs	IFS Savings from FFs
Composite Pay	$229,377.01	$788,445.79
Individual Account	$622,374.66	$1,323,041.10
	Total IFS Savings	IFS Costs
Composite Pay	$1,017,822.80	$3,439,818.39
Individual Account	$1,945,415.76	$3,439,818.39
	Net Savings/Loss	ROI
Composite Pay	-$2,421,995.59	29.59%
Individual Account	-$1,494,402.63	56.56%
Note: All costs are per 1000 starts		

Table 19. Summary of ROI Analysis Results.

F. SUMMARY

This return on investment analysis addressed the second thesis objective and the final research question: Is IFS worth the investment? With the application of both flying-hour costs and active-duty costs and the consideration of the opportunity cost savings of IFS-screened students, a net savings/loss and ROI was determined in the comparison of the IFS savings and the IFS-investment costs. The methodology was explained in detail including inflation rate, weighting factors, and mean value calculations of all costs providing the foundation for the ROI analysis.

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VI. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

Interpreting group differences on a single variable when the groups are measured over different time periods is extremely risky. In this study of Introductory Flight Screening (IFS), the non-IFS group is predominately in the first two-thirds of the three-year period and the IFS group is in the last third. The Involuntary Removal from Active Duty (IRAD) policy, accession standards, maturity of Multi-Service Pilot Training System (MPTS) syllabus and associated grading system, leadership guidance (production requirements vs. quality control), and culture of the squadrons are some areas that may have affected the groups differently. For example, as word spread over time regarding the IRAD policy, SNAs may have decided to drop-on-request (DOR) from flight training to be subsequently released from their active duty commitment (AKA *Grand Theft College*). This fact alone makes any inferences regarding other causes of changes in DOR rate over the same period potentially dangerous.

B. CONCLUSIONS

1. Effects of IFS on Primary Attrition

<u>IFS had no effect on the DOR rate in Primary and may have served to increase the number of T-34 hours per DOR.</u> With respect to students who DOR, the difference in rate between the non-IFS and IFS groups was not significant. The analysis showed the T-34 flight hours per DOR of each group were significantly different with IFS-complete Primary-DOR students having 8.34 more flight hours. Therefore it can be concluded that IFS had no effect on the DOR rate in Primary, which is consistent with the results of the 1987 USAF study of Flight Screening Program (FSP). Furthermore, IFS may have resulted in the undesired effect of actually delaying the DOR decision to later in the syllabus causing an increase in costs.

IFS served to reduce the flight failure rate in Primary and had no effect on the amount of T-34 hours per flight failure (FF)**.** The IFS-complete Primary-FF rate was 1.58% lower than was the Primary-FF rate of non-IFS participant SNAs. T-34 flight hours used by non-IFS and IFS-complete Primary-FF groups did not differ significantly. Therefore it may be concluded that IFS had a desirable effect on the FF rate in Primary and no effect on the amount of T-34 flight hours per FF. This decrease in FF attrition may be due to either the value of IFS as a screening device, training device, or both. This conclusion matches the 1987 USAF study conclusion stating that FSP significantly reduced undergraduate pilot training (UPT) attrition.

IFS did not achieve the goal for Primary-attrition reduction established in the TESCO report**.** The combined DOR and FF screening rate of IFS was 4.70%. The IFS-complete Primary DOR and FF combined attrition rate showed a significant decrease of 1.74%. TESCO predicted a combined IFS DOR and FF screening rate of 1.4% and an IFS-complete Primary DOR and FF combined attrition-rate decrease of 3.8%. Despite the actual IFS screening rate being higher than projected (4.70% vs.1.4%), the decrease in Primary DOR and FF attrition rate fell short of expectations (1.74% vs. 3.8%).

2. IFS ROI Analysis

IFS did not yield its anticipated cost-savings**.** According to a composite-pay metric, IFS resulted in a net loss of $2,421,995.59 per 1000 starts when comparing the savings of $1,017,822.80 to the IFS investment of $3,439,818.39 per 1000 starts. This was a 29.59% return-on-investment (ROI). According to an Individual Account (IA) cost metric the net loss attributable to IFS was $1,494,402.63 per 1000 starts, equating to a 56.56% ROI.

C. RECOMMENDATIONS

An effective introductory flight program implemented prior to military undergraduate pilot training should do two things well: screen and train. If introductory pilotage skills can be learned effectively in a platform that is

approximately $100 per hour instead of the $400 per hour costs of the T-34 or the $900 per hour cost of the T-6, IFS should be a viable program. IFS needs implemented exit standards to provide a benchmark for training and a tool for screening. Standardized and impartial IFS check-flight pilots must ensure these standards are adhered to. It is not clear whether IFS did an effective job at either screening or training because the two cannot be separated in this study. What is clear is that IFS must do both screening and training with more rigor to justify its costs.

1. Recommendation #1

Revisit the goals of IFS. IFS fell short of TESCO's Primary attrition goal and IFS failed to achieve the cost-savings expectations. The goals of IFS should incorporate both screening and training aspects with the objective of making IFS a cost-effective program.

2. Recommendation #2

Investigate Alternatives to Improve the Effectiveness of IFS. The following are three possible alternatives to the current IFS program: (1) add performance standards to the current 25-hour program, (2) increase IFS to a 50-hour program with the requirement to earn a Private Pilot Certificate (PPC), and (3) utilize a contractor-run single training site.

a. Alternative #1

Establish performance standards for the current 25-hour IFS program. Establish performance standards for all required maneuvers that must be achieved on a final check-flight in order to successfully complete IFS and continue into undergraduate pilot training. There are two dilemmas with the use of civilian flight instruction with regard to screening: (1) the civilian flight schools are businesses pursuing a profit and (2) the Navy has no authority and limited control over these civilian flight schools and their instructors. Use of civilian flight instructors in IFS produces a conflict of interest because instructor pilots administering check-flights are employed by the same flight schools that profit from new pilot recruitment, creating an incentive for leniency in grading and lax

standards. The civilian flight school may be concerned that rigorous screening of IFS students might hurt future business.

b. Alternative #2

Increase IFS to a 50-hour program with the requirement that each student earn a Private Pilot Certificate. With this alternative, FAA-certified examiners will ensure students meet all PPC established standards. The flight school does not employ FAA examiners, eliminating the evaluation conflict of interest described above. By increasing the program from 25 to 50 hours, an additional training benefit is likely, but will come with an increased cost. This program will require no more management effort than the current IFS program. Since the FAA Part 141 flight-time requirement for a PPC is 35 hours, the Navy has some freedom to decrease or increase the 50-hour recommendation to obtain the optimum screening benefit. The USAF is currently using this alternative, Introductory Flight Training (IFT), for their Reserve Officer Training Corps (ROTC) and Officer Training School (OTS) students.

c. Alternative #3

Utilize a single training site for IFS. To achieve ideal screening and training, a contractor-run, USN-controlled, single training site may be the optimal solution. This will allow for complete Navy control on training, grading, and screening procedures. Use of a single site will make standardization easier. A single site program will also provide to make modifications of flight hour requirements easier to implement. The Navy can align the program with a military training style and pace to increase the training value of IFS, and help establish the appropriate skill set in prospective aviators from the beginning.

The USAF is pursuing this option with a 25-hour program. The program requires the contractor to provide housing, meals, physical fitness facilities, transportation, ground instruction, flight instruction, training facilities, and aircraft for up to 1800 student pilots per year. There are at least three companies pursuing the contract: Lockheed Martin, Boeing, and DynCorp.

Lockheed Martin plans to use Craig Field Airport in Selma, AL; Boeing plans to use Webb AFB in Big Springs, TX; and DynCorp is pursuing an airport in Midland, TX (Rayko, 2005).

D. AREAS FOR FURTHER STUDY

1. Area #1

There are several areas of further study pertaining to IFS. One area is to complete a similar study to determine the effects of IFS on minorities as defined by the Department of Defense sex, race, and ethnicity (SRE) codes. Prior to IFS, civilian flight time for students was at their own expense. With a price tag of over $5000 for a Private Pilot Certificate, the low to middle income demographic family may have been incapable of affording this flight time. IFS may have served a means to balance the inequalities of the less-advantaged.

2. Area #2

The Navy's MPTS-syllabus grades students against objective performance standards, not in a purely normative scheme as it did in the previous system. Another area for further study is to examine the skills sets acquired in IFS. Specifically, determine if IFS students have a higher grade average than the non-IFS students in day visual flying, a flight stage with close correlation to IFS.

3. Area #3

A third area for further study involves the rate of learning in IFS. This may help find the optimal flight-hour length of an introductory flight program. A set of tests could be developed and administered to students at multiple points in the IFS curriculum to determine the declarative and procedural knowledge acquired by each allow and allow estimation of the slope of the learning curve at those points.

E. SUMMARY

In a time when training dollars are under heavy scrutiny, all areas of training must be closely examined. Programs, phases, stages, flights, and simulators that do not add value to the Naval Aviator production process should be improved or removed. IFS may have provided some desirable and undesirable effects on primary attrition, however, the bottom line is money, and IFS, by the metrics discussed, has provided an undesirable return on investment. There were several alternatives discussed to improve the effectiveness of IFS which should be investigated if IFS is to play a cost-effective role in the training of the world's best Naval Aviators.

APPENDIX COMPOSITE PAY TABLES

MILITARY COMPOSITE STANDARD PAY AND REIMBURSEMENT RATES
DEPARTMENT OF THE NAVY
FOR FISCAL YEAR 2002

MILITARY PAY GRADE	AVERAGE BASIC PAY	ANNUAL DOD COMPOSITE RATE [1/]	ANNUAL RATE BILLABLE TO OTHER FEDERAL AGENCIES [2/]
O-10	$132,825	$201,895	$216,028
O-9	128,993	197,042	210,835
O-8	116,797	193,525	207,072
O-7	103,594	179,210	191,755
O-6	87,259	169,503	181,368
O-5	70,157	149,525	159,992
O-4	58,558	146,912	157,196
O-3	47,830	129,568	138,638
O-2	38,316	71,932	76,967
O-1	28,845	57,002	60,992
WO-5	----	----	----
WO-4	$56,988	$102,897	110,100
WO-3	48,184	88,608	94,811
WO-2	40,802	77,110	82,508
WO-1	----	----	----
E-9	$49,278	$86,575	$100,427
E-8	40,428	73,474	85,230
E-7	34,689	64,861	75,239
E-6	29,079	55,964	64,918
E-5	25,567	46,667	54,134
E-4	18,812	38,059	44,148
E-3	15,753	31,610	36,668
E-2	14,114	27,809	32,258
E-1	12,065	23,828	27,640
CADETS	$8,400	$11,228	Not applicable

Notes: 1/ The annual DoD composite rate includes the following military personnel appropriation costs: average basic pay plus retired pay accrual, basic allowance for housing, basic allowance for subsistence, incentive and special pay, permanent change of station and miscellaneous pay.

2/ The annual rate billable to Other Federal Agencies recovers additional military related health care costs financed by the Defense Health Program.

3/ Basic pay for these officers is limited to the rate of basic pay for Level III of the Executive Schedule, which currently is $133,700 per year.

MILITARY COMPOSITE STANDARD PAY AND REIMBURSEMENT RATES
U.S. MARINE CORPS
FOR FISCAL YEAR 2002

MILITARY PAY GRADE	AVERAGE BASIC PAY	ANNUAL DOD COMPOSITE RATE [1/]	ANNUAL RATE BILLABLE TO OTHER FEDERAL AGENCIES [2/]
O-10	$133,700 [3/]	$190,719	$204,069
O-9	130,486	184,488	197,402
O-8	118,224	167,888	179,640
O-7	104,338	156,992	167,981
O-6	90,706	145,409	155,588
O-5	73,189	122,171	130,723
O-4	61,090	102,951	110,158
O-3	49,292	85,774	91,778
O-2	38,690	68,582	73,383
O-1	28,557	52,656	56,342
WO-5	$63,262	$108,532	$116,129
WO-4	54,571	94,740	101,372
WO-3	44,389	84,146	90,036
WO-2	36,852	71,430	76,430
WO-1	31,105	54,950	58,797
E-9	$50,953	$89,781	$104,146
E-8	40,959	75,001	87,001
E-7	34,362	65,243	75,682
E-6	28,139	55,513	64,395
E-5	22,130	45,656	52,961
E-4	18,604	38,358	44,495
E-3	15,887	32,874	38,134
E-2	14,661	29,890	34,672
E-1	12,517	26,579	30,832
CADETS	$8,390	$11,743	Not applicable

Notes: 1/ The annual DoD composite rate includes the following military personnel appropriation costs: average basic pay plus retired pay accrual, basic allowance for housing, basic allowance for susbistence, incentive and special pay, permanent change of station, and miscellaneous pay.

2/ The annual rate billable to Other Federal Agencies recovers additional military related health care costs financed by the Defense Health Program.

3/ Basic pay for these officers is limited to the rate of basic pay for Level III of the Executive Schedule, which currently is $133,700 per year.

MILITARY COMPOSITE STANDARD PAY AND REIMBURSEMENT RATES
DEPARTMENT OF THE NAVY
FOR FISCAL YEAR 2003

MILITARY PAY GRADE	AVERAGE BASIC PAY	ANNUAL DOD COMPOSITE RATE [1/]	ANNUAL RATE BILLABLE TO OTHER FEDERAL AGENCIES [2/]
O-10	$133,023 [3/]	$202,581	$214,736
O-9	129,424	197,795	209,663
O-8	121,041	185,932	197,088
O-7	107,222	171,330	181,610
O-6	90,491	158,836	168,366
O-5	72,771	135,730	143,874
O-4	61,237	121,521	128,812
O-3	50,084	104,896	111,190
O-2	39,730	82,670	87,630
O-1	29,890	67,406	71,450
WO-5	----	----	----
WO-4	$59,669	$109,318	115,877
WO-3	50,409	95,202	100,914
WO-2	42,645	84,161	89,211
WO-1	----	----	----
E-9	$51,869	$98,112	$108,904
E-8	42,641	84,523	93,821
E-7	37,250	75,867	84,212
E-6	30,652	65,864	73,109
E-5	24,379	55,858	62,002
E-4	19,513	46,546	51,666
E-3	16,357	39,061	43,358
E-2	15,287	36,323	40,319
E-1	12,906	32,217	35,761
CADETS	$9,080	$12,434	Not applicable

Notes: 1/ The annual DoD composite rate includes the following military personnel appropriation costs: average basic pay plus retired pay accrual, medical health care accrual, basic allowance for housing, basic allowance for subsistence, incentive and special pay, permanent change of station and miscellaneous pay.

2/ The annual rate billable to Other Federal Agencies recovers additional military related health care costs financed by the Defense Health Program. The annual billable rate includes an acceleration factor of 6 percent for officers and 11 percent for enlisted personnel.

3/ Basic pay for these officers is limited to the rate of basic pay for Level III of the Executive Schedule, which currently is $138,200 per year.

MILITARY COMPOSITE STANDARD PAY AND REIMBURSEMENT RATES
U.S. MARINE CORPS
FOR FISCAL YEAR 2003

MILITARY PAY GRADE	AVERAGE BASIC PAY	ANNUAL DOD COMPOSITE RATE [1/]	ANNUAL RATE BILLABLE TO OTHER FEDERAL AGENCIES [2/]
O-10	$133,700 [3/]	$191,869	$203,381
O-9	133,700	190,210	201,623
O-8	121,860	174,453	184,920
O-7	107,547	164,037	173,879
O-6	94,242	154,148	163,397
O-5	75,666	129,210	136,963
O-4	63,366	109,588	116,163
O-3	51,251	91,902	97,416
O-2	39,937	65,463	69,391
O-1	29,545	51,280	54,357
WO-5	$66,812	$113,471	120,279
WO-4	58,222	101,264	107,340
WO-3	48,115	86,870	92,082
WO-2	41,058	75,124	79,631
WO-1	36,271	68,430	72,536
E-9	$49,837	$91,393	$101,446
E-8	42,511	79,727	88,497
E-7	36,749	71,231	79,066
E-6	29,888	60,808	67,497
E-5	23,834	50,949	56,553
E-4	19,658	42,966	47,692
E-3	16,755	37,245	41,342
E-2	15,330	33,892	37,620
E-1	13,083	30,421	33,767

Notes: 1/ The annual DoD composite rate includes the following military personnel appropriation costs: average basic pay plus retired pay accrual, medical health care accrual, basic allowance for housing, basic allowance for susbistence, incentive and special pay, permanent change of station, and miscellaneous pay.

2/ The annual rate billable to Other Federal Agencies recovers additional military related health care costs financed by the Defense Health Program. The annual billaable rate includes an acceleration factor of 6 percent for officers and 11 percent for enlisted personnel.

3/ Basic pay for these officers is limited to the rate of basic pay for Level III of the Executive Schedule, which currently is $138,200 per year.

MILITARY COMPOSITE STANDARD PAY AND REIMBURSEMENT RATES
DEPARTMENT OF THE NAVY
FOR FISCAL YEAR 2004

MILITARY PAY GRADE	AVERAGE BASIC PAY	PERMANENT CHANGE OF STATION EXPENSE [1]	ANNUAL DOD COMPOSITE RATE [2]	ANNUAL RATE BILLABLE TO OTHER FEDERAL AGENCIES [3]
O-10	$142,500 [4]	$3,909	$218,519	$236,001
O-9	137,900	3,909	209,939	226,734
O-8	124,925	3,909	193,455	208,931
O-7	110,669	3,909	175,056	189,060
O-6	93,160	3,909	163,343	176,411
O-5	75,500	3,909	140,367	151,596
O-4	63,921	3,909	126,240	136,339
O-3	51,750	3,909	108,199	116,854
O-2	41,004	3,909	83,672	90,366
O-1	30,378	3,909	67,604	73,012
WO-5	$69,680	$3,909	$124,118	$134,047
WO-4	$63,269	3,909	115,930	125,204
WO-3	52,873	3,909	99,855	107,844
WO-2	44,287	3,909	89,737	96,916
WO-1	----	----	----	----
E-9	$55,661	$1,543	$104,083	$120,736
E-8	45,041	1,543	88,653	102,837
E-7	38,528	1,543	78,918	91,545
E-6	31,931	1,543	68,746	79,745
E-5	25,598	1,543	58,127	67,428
E-4	20,397	1,543	48,452	56,205
E-3	17,163	1,543	40,858	47,396
E-2	15,792	1,543	37,187	43,137
E-1	13,668	1,543	33,344	38,679
CADETS	$9,419	$115	$17,280	Not applicable

Notes: 1/ Represents a per capita permanent change of station (PCS) travel cost included in the composite rates not an actual PCS move rate. Calculated by dividing total amount budgeted for officer/enlisted/cadet PCS moves by budgeted officer/enlisted/cadet average strength levels. In situations where military personnel are required to make a PCS move to support a Foreign Military Sales case, the this PCS expense should be deleted from the composite rate and actual PCS costs should be charged to the case per FMR Vol. 15 Section 070203D.

2/ The annual DoD composite rate includes the following military personnel appropriation costs: average basic pay plus retired pay accrual, medical health care accrual, basic allowance for housing, basic allowance for subsistence, incentive and special pay, permanent change of station and miscellaneous pay.

3/ The annual rate billable to Other Federal Agencies recovers additional military related health care costs financed by the Defense Health Program. The annual billable rate includes an acceleration factor of 8 percent for officers and 16 percent for enlisted personnel.

4/ Basic pay for these officers is limited to the rate of basic pay for Level III of the Executive Schedule, which currently is $142,500 per year.

MILITARY COMPOSITE STANDARD PAY AND REIMBURSEMENT RATES
U.S. MARINE CORPS
FOR FISCAL YEAR 2004

MILITARY PAY GRADE	AVERAGE BASIC PAY	PERMANENT CHANGE OF STATION EXPENSE 1/	ANNUAL DOD COMPOSITE RATE 2/	ANNUAL RATE BILLABLE TO OTHER FEDERAL AGENCIES 3/
O-10	$142,500 4/	$3,335	$218,264	$235,725
O-9	139,604	3,335	197,494	213,294
O-8	126,485	3,335	180,352	194,781
O-7	111,642	3,335	176,231	190,330
O-6	96,998	3,335	160,734	173,592
O-5	78,451	3,335	136,973	147,930
O-4	65,966	3,335	119,480	129,038
O-3	53,233	3,335	100,144	108,155
O-2	41,488	3,335	81,057	87,542
O-1	30,416	3,335	63,041	68,085
WO-5	$69,206	$3,335	$113,811	$122,916
WO-4	61,180	3,335	109,875	118,665
WO-3	51,048	3,335	95,467	103,105
WO-2	43,122	3,335	81,740	88,280
WO-1	38,148	3,335	75,809	81,874
E-9	$56,348	$1,450	$101,186	$117,376
E-8	45,634	1,450	84,564	98,095
E-7	37,941	1,450	73,667	85,454
E-6	30,969	1,450	63,297	73,424
E-5	24,526	1,450	52,286	60,652
E-4	20,395	1,450	43,627	50,607
E-3	17,392	1,450	37,323	43,294
E-2	15,844	1,450	33,128	38,428
E-1	13,411	1,450	29,354	34,051

Notes: 1/ Represents a per capita permanent change of station (PCS) travel cost included in the composite rates not an actual PCS move rate. Calculated by dividing total amount budgeted for officer/enlisted/cadet PCS moves by budgeted officer/enlisted/cadet average strength levels. In situations where military personnel are required to make a PCS move to support a Foreign Military Sales case, the this PCS expense should be deleted from the composite rate and actual PCS costs should be charged to the case per FMR Vol. 15 Section 070203D.

2/ The annual DoD composite rate includes the following military personnel appropriation costs: average basic pay plus retired pay accrual, medical health care accrual, basic allowance for housing, basic allowance for subsistence, incentive and special pay, permanent change of station and miscellaneous pay.

3/ The annual rate billable to Other Federal Agencies recovers additional military related health care costs financed by the Defense Health Program. The annual billable rate includes an acceleration factor of 8 percent for officers and 16 percent for enlisted personnel.

4/ Basic pay for these officers is limited to the rate of basic pay for Level III of the Executive Schedule, which currently is $142,500 per year.

LIST OF REFERENCES

Carretta, Thomas R. (2000, September). *U.S. Air Force Pilot Selection and Training Methods.* Aviation, Space, and Environmental Medicine, 71:9.

Chief of Naval Air Training Instruction 1500.4F. (1999, May 18). *Student Naval Aviator Training and Administration Manual.* Corpus Christi, Texas.

Chief of Naval Air Training Instruction 1542.8J. (2001, March 19). *Preflight Training Course Control Document*. Corpus Christi, Texas.

Chief of Naval Air Training Instruction 1542.140C. (2003, June 25). *Primary Multi-Service Pilot Training System.* Corpus Christi, Texas.

Chief of Naval Air Training Instruction 3501.1. (2002, December 16). *Introductory Flight Screening (IFS) Program.* Corpus Christi, Texas.

Department of Defense Fiscal Years 2002-2004 Reimbursable Rates. *Military Personnel Composite Standard Pay and Reimbursement Rates (Tab K).* Retrieved May 2005, from http://www.dod.mil/comtproller/rates/.

Hays, William L. (1994). *Statistics, Fifth Edition*. Forth Worth: Harcourt Brace College Publishers.

Rayko, Rebecca. (2005, June/July). *Out of the Nest: Competition Heats Up to Train Fledging U.S. Air Force Pilots.* Training and Simulation Journal. 26-28.

Secretary of the Air Force Inspector General. (1998, March 17). *Broad Area Review of the Enhanced Flight Screening Program*.

TESCO, Incorporated. (2000, October). *Process Improvement in Accession of Prospective Student Naval Aviators* (Contract N00421-00-F-0549). Pensacola, Florida.

USAF Aviation Education and Training Command News Release. (1999, October). *Air Force Terminates T-3 Flying Program*.

USAF Aviation Education and Training Command. (2002-2003). *History*, pp. 190-194.

USAF Manpower and Personnel Division. (1987, August 11). *Flight Screening Program Effects on Attrition in Undergraduates Pilot Training.* Brooks Air Force Base, Texas.

USAF Message 291819Z. (1999, December). *Introductory Flight Training Policy Message.*

United States Department of Labor: Bureau of Labor Statistics. *Table Containing History of Consumer Price Indexes and Annual Percentage Changes from 1913 to Present (All Urban Consumers: CPI-U)*. Retrieved June 2005, from http://www.bls.gov/cpi/home/htm.

Webster's Dictionary. (1971). Merriam-Webster INC., Publishers. Springfield, Massachusetts.

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